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The Magazine of the American Museum of Natural History

FREDERICK TRUBEE DAVISON, President — ROY CHAPMAN ANDREWS, Sc.D., Director

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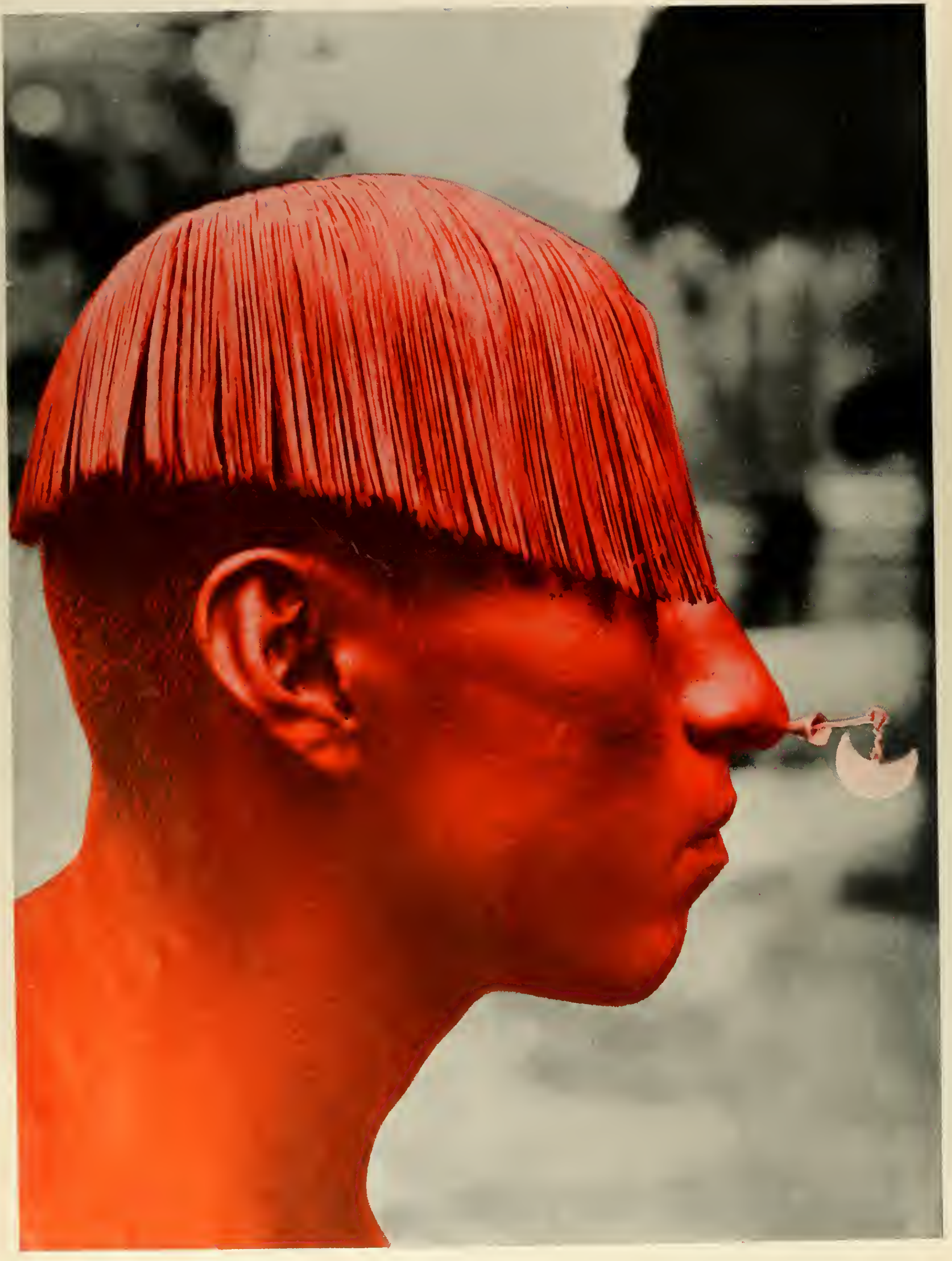

Red Dye in Place of Clothing

In the bright red paint which he habitually wears over his entire body and hair, this Colorados Indian poses for perhaps the only series of photographs ever to illustrate their remarkable styles and customs. This little-known tribe, whose name appropriately means The Red Ones, lives near the equator on the western slope of South America's Cordilleras

SCARLET MEN—*Strange puberty rites are witnessed among the little-known Colorados Indians of Ecuador, who day in and day out paint their entire bodies red*

By WOLFGANG VON HAGEN

WE had heard of the Colorados Indians, and when at last we decided to investigate this little-known tribe we could find nothing about them. We were given to understand that they lived on the Pacific slope of the western Cordilleras. For nearly two years I had inquired occasionally about them and in Quito had visited the monasteries of Santo Domingo, San Augustine, and the monks of La Merced in an attempt to learn more of them. For generations these monks had worked among the Indians of Ecuador, yet they could add nothing to the scant information I already had. The Indians lived in the jungles at the base of the western Andes; they were nearly exterminated; they had been Christianized; and that was all I could gather.

Armed only with this vague information, my wife and I, in July 1936, crossed the *paramos* (moors) of Ecuador's gigantic mountain system and made our way toward the pueblo of Santo Domingo de los Colorados.

As soon as we left the few main thoroughfares, we traveled on mule-back for that was the only means of reaching our destination.

Red shadows in the jungle

Four days astride a mule, riding down mountain ranges, climbing others, crossing perilous *quebradas* with great yawning depths, brought us to the little village of Santo Domingo de los Colorados. It consisted of a score of grass-thatched houses, laid about a barren square, euphemistically called the Plaza. We presented our letters to the local *Teniente Politico* and made inquiries about the Colorados Indians. And here the Indians became very real indeed. We learned that most of the Indians lived about this village and another farther south called San Miguel, but none lived in or near the town although they were wont to visit it on Sunday. Knowing this, we built our camp ten kilometers from the village.

Three days after our arrival, my wife was startled by a group of Indians staring timidly at her as she was drawing water from the stream. At her exclamation of astonishment I came out of the tent and the Indians fled, but as they fled I saw them brilliantly scarlet against the green of the jungle and I knew then why they were called *Colorados,* "The Red Ones."

An unearthly sight

I shouted to them to return and shortly afterward, as we busied ourselves about the camp, a whole group of them came out of the forest path to our clearing. There were five men and three women, as picturesque a group as one could find anywhere. They were really Red Men. From the hair of their heads to the soles of their feet they were a bright scarlet. They were naked save for a short skirt wrapped about their loins, which was called *umbatsompa;* and on their heads was a sort of crown of spun cotton that looked from a distance like a calotte. They were of medium height, about five feet four inches, with rather slim, extremely well-developed torsos, and heavily developed lower legs with correspondingly wide feet. Superimposed upon the red color some had drawn intricate patterns of black horizontal lines with short perpendicular marks, and my wife noticed that the same motif was repeated in the pattern in their weavings. About their wrists they had silver bracelets, two inches wide, which they called *kalateshli.* Their speech was singular and although I knew some

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IMPORTANT NOTICE TO MEMBERS

Natural History is not published during July and August. Therefore it will not be necessary for members to send in a change of address notice if they are to reside at a summer residence during these two months.

Quechua and had been among the Indians of the Amazon region for some time, I could discern no similarity.

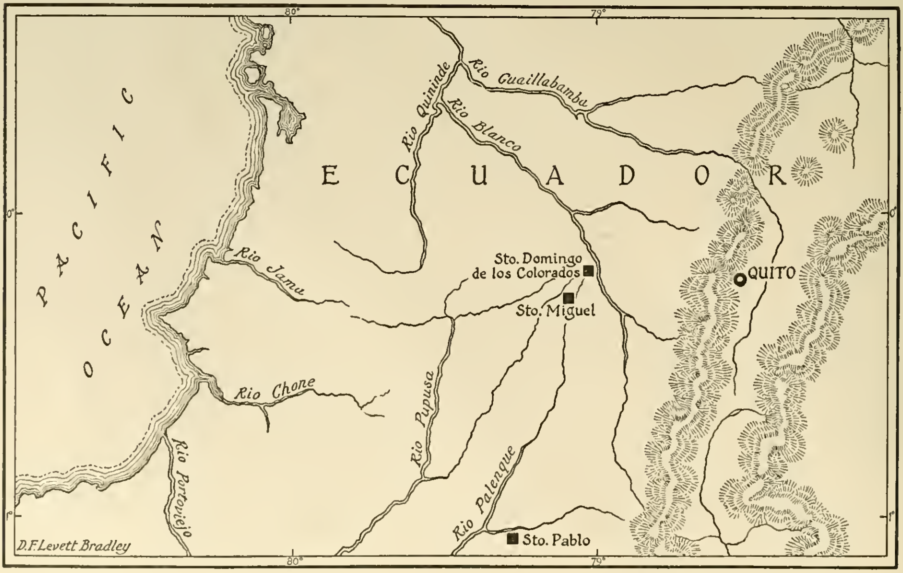
Like all Indians they were shy, but on receiving tobacco and a few trifles from us they came within our camp and squatted about. The women never lost their shyness or reserve. They too were naked save for a skirt and a piece of cotton cloth tied around their necks, which covered only their backs. Their hair was long and black, but unlike the men, only their faces and the crown of their heads were painted red.

The men were a curious sight because of their coiffure. The hair was cut short in a "bowl-trim," with the bangs extending over the eyes, and the back of the head and neck clipped so short as to appear the result of professional hair clippers. So long did their hair grow before their eyes that when looking at an object the Indian had to tilt back his head in order to see. Still more singular was a wooden plug which they all wore in the center of their noses. It was about the width of a match stick. I pointed to it and asked in gerundive Spanish what it was. With boyish laughter in which the whole group joined, one of them pulled out the plug and said *"Kimfudse,"* then returned it to the hole in his nose, amid a pandemonium of Homeric laughter.

Formalities

We performed the usual amenities of presenting parting gifts. To the men we gave powder and shot; to the woman mirrors and needles. They left then, but offered to come for us later and accompany us through the forest to their own homes.

The Colorados Indians are the least known of the groups of Indians in accessible parts of America. They live at the base of the western Andes in Ecuador, 2010 feet above sea level, and approximately 150 miles from the Pacific Ocean. They are not a strictly river people, for they live in the upper tributaries of the Esmeraldas river system where the streams are too small and swift to navigate, and consequently their small canoes are crudely made and only used to hold food or drink. The few authorities who have visited them suggest that comparative anthropology and linguistics link them with the Chibchas, who formerly lived in the highlands of Colombia before the advent of the Spaniards. They live and apparently have always lived on the



WHERE THE "RED ONES" LIVE

In the region of the three South American villages marked here by squares dwell the Colorados Indians, who exhibit the curious custom of wearing red paint continuously over their entire bodies. Numbering approximately 250 souls, their settlements lie at the base of the western Andes in Ecuador, about 150 miles from the Pacific Ocean general "via" that the ancient Caras were supposed to have taken when they migrated from the immediate Pacific Coast up to the Sierras in and about Quito. Their forests are extensive and contain considerable game, and they are high enough to be out of the range of stagnant pools and therefore of the malaria-bearing mosquitoes.

Origins

Who gave them the sobriquet *Colorados* my researches have not revealed. Apparently the conqueror of Quito, one Sebastian de Belalcazar, first journeyed among them sometime in 1540, but history tells us nothing of them, principally, I suppose, because they offered no resistance and had no riches to be pillaged by the conquerors. Doubtless they were once a great tribe stretching for hundreds of miles through the upper reaches of the Guayas river system into the Cordilleras up to 5000 feet. This is apparent from some of the early maps, for the tribe is designated as being composed of two groups; *Colorados de Santo Domingo* and *Colorados de Angamarca.* And the myths of the Indians confirm this. Into their mythology the horrors of the eruptions of the gigantic volcano Chimborazo (extinct for centuries) has entered. From their present territory this snow-covered volcano cannot be seen; thus it is concluded that a sub-tribe lived formerly farther south, within range of Chimborazo.

The Colorados call themselves *Tsatchela* which merely means men, the word *Tsatchi* being the singular. Contact with white man has robbed them of much of their independence and almost wholly of their tradition. Yet it is significant that their dress remains unaffected by this association. Commonly the reverse happens. An Indian usually begins to wear white man's clothes but keeps to his own customs and traditions. Here the Colorados refuse absolutely to buy anything that would change their attire, but they have taken white man's religious beliefs to such an extent that to attempt to analyze their spiritual ideas leaves one in a hopeless muddle of half-Christian, half-Indian traditions.

Crops

A few days later we returned the visit of the Red Ones. As in Upper Amazonia, so here, we found the houses of the Colorados in the deep forest, near a stream of water, and in the center of rather vast fields under cultivation. Bananas of innumerable varieties, yuca, and camotes are planted in neat plantations near the dwelling, and in the sub-fields away from the house, sugar-cane and pineapples are grown extensively.

Our Virgil in this first visit to the Colorados was a young Indian of handsome stature. He referred to himself as Compadre Carlos as this was the name given to him by one of the *padres* in one of their infrequent visits to the region. His house, typical of the Red Indians, was a large, partly open structure consisting of two sections: an unenclosed space where guests were received, and another section, closed with split palm uprights where the occupants slept and prepared their food. The house was thatched with certain kinds of palm trees, and all the uprights were bound, as is usual, with rope-like lianas.

We had arrived at the time of a small *fiesta.* By a singular coincidence we came when one of the small boys was to be initiated into the *Kimfudse* ceremony, which is, or at least was in ancient time, a puberty ceremony. Now it is an excuse, one might say, for dancing and drinking. A score or more of the Red Ones, male and female, were there, brilliantly decorated with red paint and with their faces well marked. As the day was cold and overcast the men wore toga-like robes. The women sat apart from the men, who were already slightly inebriated from drinking their own concoction of fermented sugar-cane juice. They idly gossiped and indulged in displays of Rabelaisian humor.

Unlike the Amazonic tribes, the Colorado is monogamous. This I assume to be the result of their docile acceptance of Christian teachings. These however, are largely superfluous with them, as they are a peaceable people who have never been known in historical times to kill one another, and have a natural sense of honesty and property rights. They nevertheless adore to be baptized and to be given *nombres Christianos;* yet they retain their original name given by their parents, and so can almost be said to have adopted Linneaus' binomial classification.

Kototo was the boy to be initiated into the ancient rites of the Colorados. Kototo had a Christian name, Nicholas, but as Kototo means "frog" and as his temperament reminded us of this amphibian we gainsaid the *padres* and called him Kototo. While his elders were preparing for the ceremony we made a bargain with the neophyte. In exchange for a small knife that I carried he would let us watch and perhaps photograph his own preparations for the occasion.

With this arrangement sealed, he led us to the "blood-tree."

Source of red dye

This is a famous plant in the Americas, for it is and has been in the past, the source of much of the red dye obtained by the Indians. The tree (*Bixa* *orellana*), more correctly a bush, is known as *achiote.* It is ten feet high with wide spreading branches, and when in bloom has a flower not unlike a white cherry blossom, which gives a pod the size of an apricot. Kototo gathered a score of these pods and, plucking a banana leaf, emptied the contents of each pod onto the leaf. Within each pod were small vermilion seeds similar in shape to grape seeds. The color came off easily. Kototo took them in his palms, spat generously on them, rubbed them in his hands as if he were washing them, dropped the seeds, and applied the red paste to his hair.

His hair became brilliant red and stiff from the natural wax of the seeds. The rest of his body was similarly colored and then covered with a design of black lines. Kototo then combed his hair and cropped it in the conventional "bowl-trim" with an old pair of scissors. I assumed that this custom of cutting the hair was part of their tradition and I wondered with what they had cut it before the coming of the white man's steel scissors.

"Why do the Colorados put on *mu* (achiote)?" I inquired.

"Because we have always painted," Kototo replied.

I persisted: "But why?"

"*Costumbre* (custom)," he replied with a finality which left nothing more to be said.

The Colorados, like all Indians, do things because time and custom demand that they do them, because they have always done them. It is my opinion that beneath the painting there is a blood symbolism. This dye is called *mu,* while blood is *asa,* and they do not directly associate the two; all Amazonic tribes use this color to some extent and paint their faces seemingly as protection against the genii of the forest, wind, water, in short everything which is animated in their world. Since the symbolism of primitives generally has a realistic basis, a symbol like *mu* may once have been regarded as the identical equivalent of blood. Primitives the world over have in the past painted themselves with human blood or with the blood of fowls or have used either red vegetable dye or red ochre of the earth. The primary purpose, one would assume, is to increase the vital principal against the unseen forces of evil and to bind the ties of blood-unity within a group. The matter is, however, debatable; but whatever the explanation, no people push this idiosyncrasy of painting to such lengths as the Colorados. Seldom the moment, day or night, when they are without some color on their hair or bodies. The stuff is quite indelible, and I have seen the Colorados pass through a heavy rainfall and still retain most of their red color. My wife found the seeds an excellent substitute for lip rouge. Seeing my wife using an achiote seed for this purpose, Kototo remarked:

"But why does she put it only on her lips; why not all over?"

The nose ornament

When we returned with the neophyte, Kototo, the elders were ready to carry on the puberty ceremony. One, Carpintinu by name, a tribal leader of some repute, was to make the painful incision in the nose of the boy. Before the event Carpintinu had taken some of the magical brew, known generally as *Aya Huasca* or "vine of the souls," which contributes to a form of augury for the puberty events. The witch doctor pulled the small wooden peg from his own nose and inserted a large silver ornament called *sopue.* It was five inches long and had at the end a small crescent; and by passing it through the hole in front of his nose the end came out through the nostril. Those present who had such ornaments did likewise.

Kototo was then seated on a small bench and with a small thorn of the Chonta palm the shaman began to make the incision. One can judge how painful this is, yet the boy said not a word. Patiently enlarging it and giving the boy occasional drinks of their potent brew the incision was made through the tip of the nose. A small bit of string was put through it, and the ceremony then ended. Kototo was left to wander away. His duty now was to keep pulling out the string and replacing it with a larger piece until the hole was large enough eventually to receive a small plug called *lansa.* The word *kimfu* means nose, so the term *kimfudse* apparently applies to the ceremony itself. Undoubtedly in the past there was more ritual to this than that which now takes place, but it has been forgotten or mayhap not practiced when strangers are present.

Native brew

With the *Kimfudse* finished the tribe took to their bacchanalian orgies. The men drank copiously of a brew peculiar to their tribe called *malakachisa.* It had been made from the fermented juice of sugar-cane and yuca. The process of preparation was a bit disgusting. Women chewed the yuca tuber and spit out the masticated mass. This process turned the starch into sugar which, with the help of the saliva, fermented. This mass was mixed with sugar-cane juice which had been pressed out of the cane by an ingenious roller system into a small canoe. In three days the brew had developed quite a potency and assumed quite a sweet flavor. Unlike white man's rum (which universally deteriorates the Indian), this drink appears to do no harm.

The men quaffed generous gourds of the liquid and before nightfall had reached the Valhalla of inebriated souls and had fallen where the dance had precipitated them. At once one of the women took charge of these sons of Bacchus, and it was a pleasing commentary on the Indian's social system to watch the tenderness with which the women watched over their drunken sons, fathers, or husbands. Even when drunk the Colorados were a pleasant, inoffensive people, toward whom one did not have the slightest feeling of repugnance, as it all seemed to proceed from an exuberance of animal spirits.

Their dance had degenerated into a hopeless bouncing, apparently an imitation of what they had witnessed in the villages of the *cholos*.

The same could not be said about their music, which on the contrary had definite feeling. The Indians' musical instruments were the flute, a large, tubular drum made of balsa wood and covered with deer hide, and the marimba. The marimba is a cultural loan from the negroes of the coast. It was made of solid chonta palm bars and hollow bamboo trunks to carry the sound. The scale was typical of our complete range and the instrument was usually played by two or three people at the same time. Like all primitive music it tended to be repetitional, and was best played when the performers were drunk.

I listened intently to an elderly Indian playing a bit of very impressionistic music which reminded me of the flow of a small brook. It seemed to have a rising and lowering tinkling sound such as water makes in a silent wood.

"It sounds like an *arroyo*," I remarked to the old fellow.

"Si, si," he replied, *"pita luna,"* which in his language means the small-source-of-big-rivers.

I tried to record the distinct types of melodies but ended when I had counted thirty, and I do not feel that I had heard them all.

Darkness did not end this bacchanalian festival. Torches were brought and those who could rouse themselves partook of food and more drink. The festival went on for three days, but we felt we had had enough for the first time.

Medicine men

The Colorados are patriarchal in their government. Each house is distant from other dwellings and the elder male is the ruler of his house. Houses are generally situated about a mile apart and seldom consist of more than fifteen people or less than four. Although they are Christians by name their witch doctors act in consultation in cases of illness. Shamans play a great rôle in the lives of the Indians as augurers, conjurers, magicians, rain makers, depositaries of tribal tradition, and diviners; but mostly they flourish as "agents of cure." To the primitive mind disease and death are caused not by something but by someone; thus, when the Colorado is ill he has been possessed by *yukani,* a demon; and his illness is called *yukangkeahoe,* i.e., "possession by a demon." When a Colorado is thus stricken, irrespective of the cause, he repairs to a shaman to be cured.

Upon one occasion I accompanied a young Colorado to a witch doctor. My Colorado did not seem to be ill, but in his own mind he was "possessed"; so taking advantage of this opportunity I went with him to the home of the witch doctor.

With a bit of bribery and some cajolery I asked the shaman if he would allow me to watch him while he prepared *Aya Huasca* (the vine of the soul). I knew that this concoction was known the length and breadth of the Amazon as a vine, a bush, a tree or whatsoever name the traveler in question wished to call it; and because of the varied uses to which it was put I was anxious to see it for myself.

Spruce, the botanist, identified the plant as far back as 1856 as a vine of the Malpighiad species and called it *Banesteria caapi, caapi* being the name in the Tupi Indian language for it. It is a narcotic vine, and is a cultivated plant which is tended by the shamans.

Preparation of drug

Roots of the plant were cut off before my eyes and the epidermis scraped off; then the root was pounded to make it more permeable, and immersed in water brought to a boil. The contents were strained and the concoction drunk.

From his small sack the shaman produced four stones. They were black, and rounded from the action of running water. The shaman was at pains to explain that these were not stones that anyone might pick up. One must be versed in the arts of the "cure" to know just which stones to select. Since Chimborazo and Cotopaxi are believed to be the abode of sorcerers (hence their eruptions) the stones were supposed to come from these sources and to be possessed of deep magical power.

The witch doctor then drank the liquid, swallowing a portion of it, and spewed the rest across the stones, apparently to awaken the magic that they possessed. The patient was also given generous quantities of the narcotic, for an essential part of the cure was that both doctor and patient be hypnotized so that the actions of the demons who responded to the efforts of the witch doctor would be discernible to both.

Beating his drum, in a quasi-hypnotic state, the shaman conjured up the spirits and then proceeded to chant over the body of the reclining narcotized patient. He then seized the stones which had been wet by the spewing of the *Aya Huasca* (*Nepe,* they called the fluid), and began to dance with them in his hands, chanting all the while. The dance is called *shukade,* "the dance-of-the-stones." Thereupon, with much blowing and chanting, he proceeded like a masseur to rub the patient's body with the purpose of drawing out the pain; and, pulling out a thorn he contended that he had removed the fairy-dart. The *yukani*-demon had been extracted and thus my companion was cured.

The drug analyzed

The narcotic *Nepe* which I had seen given, has been analyzed from actual *caapi* roots by Doctor Seil of New York, and found to contain a strong phenol-alkaloid in such quantity to produce a hypnosis and evoke fantasies. Many ethnologists have felt that the ecstasy experienced by the drinker was psychological, produced one might say by auto-hypnosis; but the chemical analysis of *Banesteria caapi* leaves no doubt as to its effect on the nervous system.

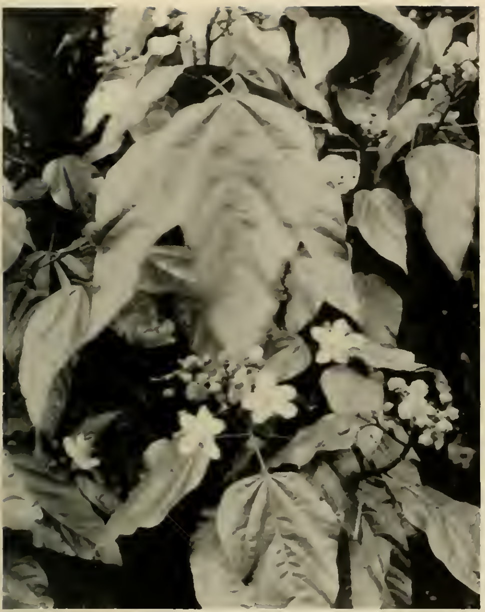
Sometimes, of course, the patient dies, usually nowadays from a contagious disease such as smallpox or measles. All the black magic that the shaman can conjure means nothing in the face of such a disease. For by such epidemics the tribe has been much reduced, until at present there are only 250 souls remaining, a pitiful remnant of a once great tribe.

Contrary to the usual custom of Amazonic Indians of burying their dead in the house, the Colorados bury their dead in deep recesses in the jungle. A hollow log, simulating a canoe, is made to hold the body. To one finger is attached a length of string, which remains affixed when the body is covered with earth. This piece of string is then tied to some neighboring branch, signifying that the soul of the deceased is still within the body. So long as the string remains intact food must be brought to the grave for the soul's nourishment and traditional funeral ceremonies must be observed. Of course the string is fragile. The humidity, wind, or falling branches soon snap it and then the Indian understands that the soul of the dead Colorado has passed on to the realm of shades. Primitives and people of yesteryear (and also ourselves) sometimes bow only half-heartedly to casual fears of the dead. While complying with custom there is apt to be a bit of skepticism. It is interesting to recall that when archaeologists uncover interred ancient Greeks they find in their mouths the obolus to pay for the passage across the river Styx. Yet it is not a gold coin, but a miserable bit of brass. As the Greeks would fool the gods with these imitations, so our Colorados with their breaking-string pay casual tribute to the shades.

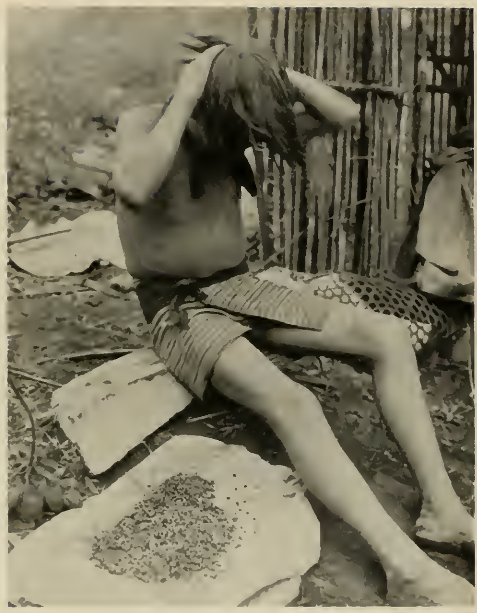
Friendly savages

We had spent eight weeks among the Colorados. We carefully photographed them and made detailed studies of their unsullied customs. We collected plants in order to gain some idea of their ethno-botany, and arranged a long vocabulary of their language. We grew immeasurably fond of these fine savages, who were so responsive to kind, considerate treatment. When we left, a few of the Colorados accompanied us down to the Rio Toachi which was the route we were to take to the Pacific Coast. It was with poignant regret that we took leave of them, knowing that in a few short years they will be extinct.

As we first saw them, so we saw them for the last time; scarlet red figures running until they disappeared into the emerald green forest—the last of the Colorados, who may forever remain essentially a people of mystery.



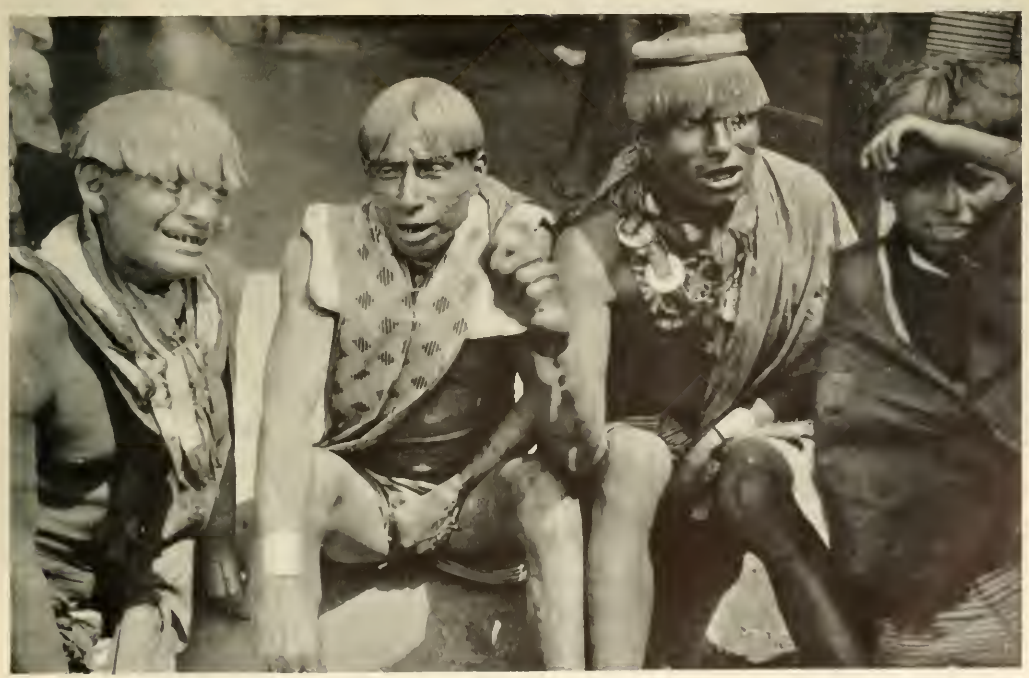
THE BLOOD-RED DYE with which the Colorados Indians paint their entire bodies is made from the seeds of this bush, *Vixa orellana*. The dye is the color of ordinary lip rouge, is harmless, and will last for days

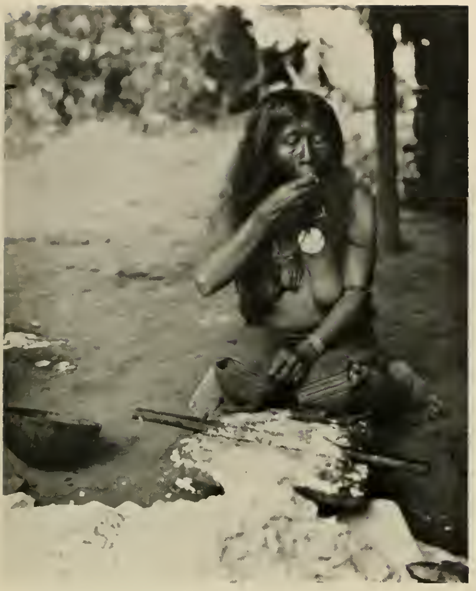


A YOUNG COLORADOS applying the dye to his hair. Beside him on the banana leaf are the red seeds which he rubs between his hands in combination with saliva. A wax which the dye contains makes the hair stiff

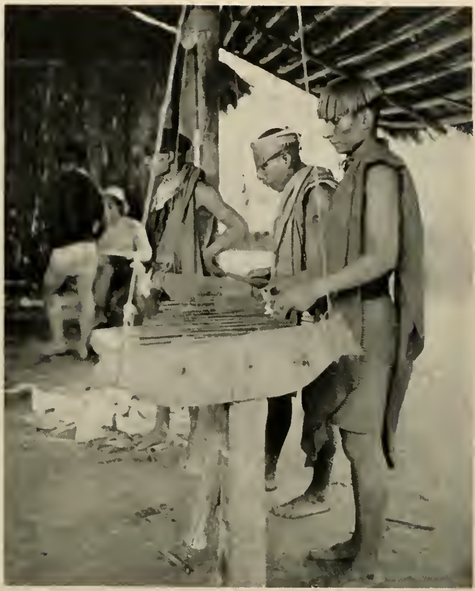
THE PUBERTY CEREMONY is accompanied by copious drinking of the native brew called *malakachisa* whose effects these Indians are feeling. One wears a necklace composed of perfume bottles, mirrors, medallions, seeds and whatever else he may believe to possess magical power

(All photographs by von Hagen)



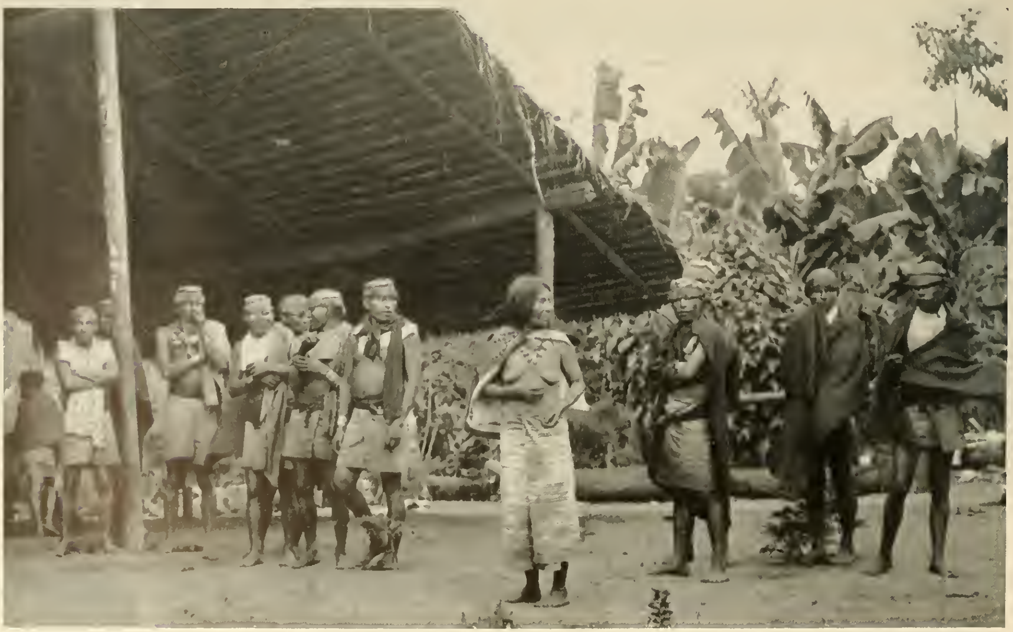


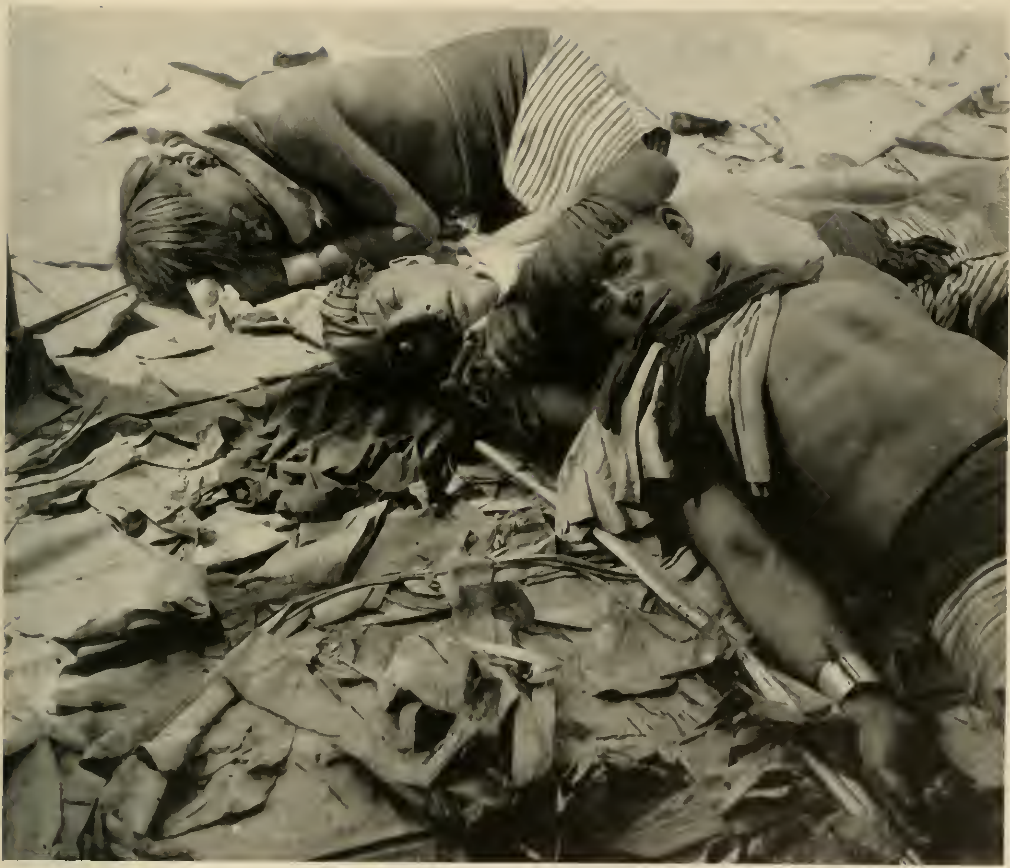
A BEER MAKER OF THE COLORADOS. The woman chews the yuca tuber and later mixes the mass with sugar cane juice. In three days the sweetish brew has developed considerable alcoholic content



IMPRESSIONISTIC MUSIC FROM THE MARIMBA accompanies the dancing. The author counted 30 distinct melodies during a short period. The marimba is a cultural loan from the coast negroes

AN INTERMISSION IN THE FESTIVITIES. The typical house of the Colorados (at left) has two sections: an unenclosed space where guests are received, and a closed one with split palm uprights where the occupants sleep and cook. The Colorados are a peaceable people; they accepted Mr. von Hagen and his wife hospitably and did not hinder them from taking this remarkable series of photographs



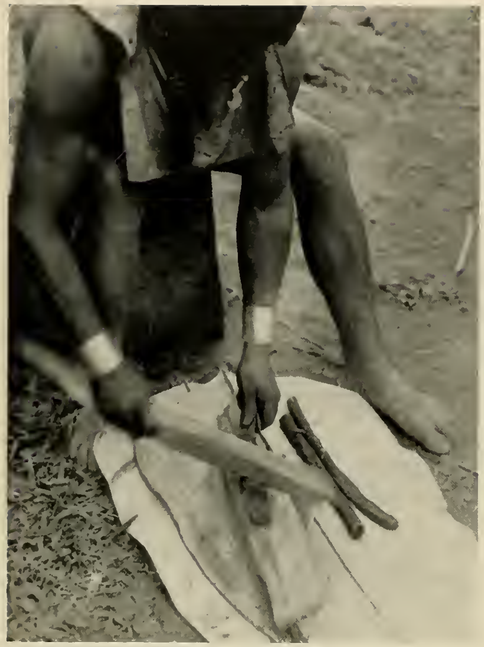


THAT THE "RED ONES" are not immune to the effects of their own brew is shown by this photograph taken at the end of the festival. If the camera had recorded color, the bodies, faces, and hair of these men would be bright red

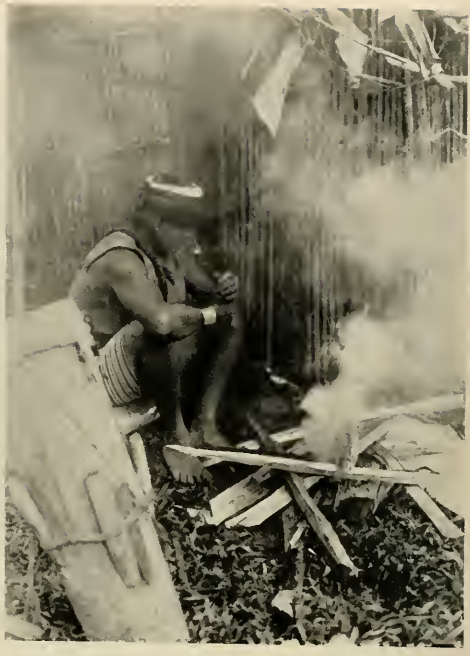
THE DOCTOR as well as the patient takes the "medicine": a Colorados sorceror who has drunk a quart of the native narcotic, *Nepe*

THE NARCOTIC VINE cultivated by the witch doctors: a Colorados Indian explaining how the plant, *Banesteria caapi,* is grown and utilized

PREPARATION OF THE DRUG: A Colorados Indian scraping the roots, which chemical analysis has proved to contain a strong phenol-alkaloid



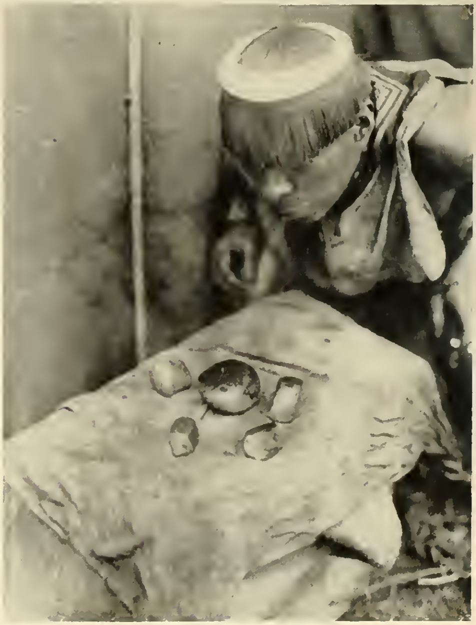
The root is bruised by pounding—



Then Boiled to extract the narcotic

The *Nepe* is allowed to become tepid before it is drunk. Sickness is believed to be caused by evil spirits; and the narcotic with the hallucinations that accompany it, is thought to assist the doctor and patient in effecting a cure

The narcotized shaman sprays his magic stones with the drug, then dances with them in his hands, and ends with a vigorous massage of the patient. Thus the scarlet witch doctor treats his scarlet patient



THE WOMAN WHO KNEW PEARY—*In youth, Arnahwee's proud and fiery temperament won her much power in her tribe—and also enemies. How she met the hardships of old age, reveals a depth of personality unusual in a primitive person*

By CAPTAIN BOB BARTLETT

Schooner Morrissey

ARNAHWEE'S people, the polar Eskimos, have no written history. If they had, her name might go down like that of a Cleopatra, a Joan of Arc, or a Florence Nightingale. She had the qualities that set her head and shoulders above the crowd.

We are all a little sad, I believe, to meet an old friend after many years. It is apt to make us feel the full weight of the years and we see never more clearly the swing of the pendulum. I knew that Arnahwee after nearly forty years would have lost the priceless things that vanish with youth. Old age was liable to go harder with her, an Eskimo, than it commonly does with civilized people.

So a strong melancholy came over me as we sailed toward Kangeralooksoak in Inglefield Gulf, far up in Greenland. For that was where we would see her if we were to see her at all. A light, north wind and ebb tide had packed bits of broken berg ahead of the vessel, and I went aloft to have a look.

A different Greenland

Time was when one couldn't steal into a native village on this shore without arousing a bedlam of sledge dogs and having the Eskimos swarm out of their little beehive-shaped homes full of keen excitement. But not so now. The families have been scattered and reduced by sickness. Civilization has brought great sorrow to these people and is threatening their very existence. No longer are they the carefree race that we first met thirty and forty years ago.

This village that we were approaching seemed to be dead. Inglefield Gulf was drenched in brilliant sunshine and the bowl of blue reflected the warm color of the Mediterranean, with not a cloud in sight. Above the rocks on which the little huts stood, the mountain slopes rose with patches of green grass here and there, heralding the approach of the brief Arctic summer, while above and all round the white peaks with their snowy crags stood clear and brilliant. The scene was beautiful but lacked the movement of figures scurrying on the beach and the cries of voices that once had livened it. No fleet of kayacks had come skimming over the water at sight of the *Morrissey*.

My brother Will relieved me in the crow's-nest and on deck I fastened my eyes on the shore. Presently several figures emerged from the doors of their half underground huts and started down to the water's edge. Most of them were children, but suddenly I heard a voice behind me say:

"There she is, Sir!"

It was Billy Pritchard, the *Morrissey's* perennial cook, who had been with me many years, and was with Peary in the old days. He did not need to mention the name of Arnahwee. We had both been thinking of her.

"Can't you hear her?" he exclaimed. "Glory be to God! It's Arnahwee herself."

Fine furs

Even without the aid of binoculars I could recognize her, for no other Eskimo woman knew how to dress and wear her clothes as she did. No Eskimo woman would dare wear the beautiful fox skin *kapatait* on a summer evening as she would. She was the personification of *noblesse oblige* in Eskimo land. She was giving the kids h—l and we could see that she lacked none of her old fire. There was something warming in this show of spirit.

But it was her clothes that told us who she was. Arnahwee was always the best dressed woman among the Polar Eskimos. Her furs were always of the best skins, carefully cleaned, dried, cured and sewn. Her fox skins, blue and white, were caught by herself and tailored with her own matchless fingers. She was not anything that one would rave over as far as pulchritude was concerned, but she always carried her sails well and looked like a million dollars.

We steamed in toward the village, slow ahead. It was calm and still and the ice began to open ahead of us as the tide still on the ebb, slackened. I sent the whale boat ashore with Billy in it to bring Arnahwee on board.

Looking backward

I became lost in thought of the time when I had first seen Arnahwee. She was climbing over the rail of the Peary Arctic Club ship *Windward.* She moved with the grace of a sleek young animal and was, as on every subsequent occasion, beautifully clothed in lustrous furs. She was only about twenty-five, I should say, but she had the dignity of a woman whose every wish and word commanded respect. Behind her came Assayoo, her husband. He too was a conspicuous figure. Above the average Eskimo in stature, he was a majestic figure with his long, jet black hair, as lustrous as the tail of a high breed horse, hanging down to the top of his snowy polar bear skin trousers in the old-time Eskimo mode. From his immaculate, beautifully matched seal skin parka to the soles of his well-made kamiks, his tailoring reflected the pride of his matchless seamstress Arnahwee.

The Polar Eskimos have no chiefs or other rulers. Their society is as thoroughly democratic as any in the world. Yet Arnahwee and Assayoo, by sheer force of their personality, made an obvious exception. The respect which they commanded among their simple kinfolk was equivalent to the highest prestige that one can win in a civilized country.

What saddened me as I waited to talk with her was that I knew full well that she must have suffered much privation and loss of authority in her declining years. Old age is not apt to be happy among the Eskimos. And in Arnahwee's case the fiery temperament of her youth was not a thing that would have retained loyalty in old age. Arnahwee had no women friends—she was a man's woman.

During those years from 1899 up to 1909 when Peary discovered the Pole, she became more and more a force to be reckoned with in the goal which we had all set our hearts on. She was a diplomat and it was not beyond her to use the ways that are familiar to clever women the world over. When she heard gossip she knew enough not to pass it on except to her strategic benefit. Thus she got her own way with the expedition beyond what was perhaps altogether desirable. This created jealousy among some of the others. She would not use her tongue to the full except when backed into a corner, but then she could certainly make the sharp words fly. She made enemies, and enemies in an Eskimo community can make it hard for one as the years roll by.

From the deck of the *Morrissey* I strained my eyes to see her reactions as Billy, the cook, went forward to meet her. I could not have sent a better emissary than Billy for he had known her long and could converse in the native language. She became almost hysterical. She laughed and cried all at once, being overcome with delight and at the same time childishly moved at what was so great an occasion in her remote and monotonous life.

Arnahwee made her way to the whale boat, majestic even though she was too feeble to move fast and had to rest in spells. Also she wanted to keep her clothes spotless. From time to time I could hear her roundly scolding the kids about her.

I waited for them in the cabin, and when Billy came in I must have been completely lost in reverie, for he said, "My God, Sir, I thought you had a stroke. She's here, all dressed up."

A fitting reception

She climbed down the ladder into the cabin and in a burst of laughing and weeping let out a flood of words. I had her seated in my big armchair with a fine cushion behind her. Nothing was too good for Arnahwee. Over and over she kept repeating the names of the people she had known. A snowy, linen tablecloth was spread on the chart table and we tried to serve her in a way befitting her dignity and reputation. Tommy, the mess boy, had prepared fresh, hot bread and brought it all cut up with plenty of butter on it and a pot of tea freshly brewed. There was milk and sugar aplenty, and jam and fancy Sunshine Biscuits.

I thought her heart would burst with the outpouring of tears. Believe it or not, it also affected Billy, who is hardboiled; and I am not ashamed to admit that there were tears in my own eyes.

As I feared, foremost in her mind was the fact that she was growing old. She recalled how she had hunted musk ox, even like a man, during the two winters we had passed at Grant Land in the *Roosevelt;* how she had fought and killed a wolf in the Lake Hazen country; and how once, when a polar bear threatened her alone in her igloo near Parker Snow Bay she had, without dogs or rifle, lanced and killed it. In those days she could build a snow house as well as any Eskimo man. She could drive dogs as well as the best of them, could repair a sledge or build one if need be. She was a tower of strength in times of stress, famine and a sorrow of a big kind. She had shared so much of our joys and heartbreaks. Assayoo, her husband, whom she had kept immaculate, making all the women jealous by her skill with the needle, had passed on. It was touching to remember that she had sometimes resented Assayoo's slowness and had sometimes thrown stinging words at him. But he never answered her back. He knew she was right and he knew her worth.

Rich memories

But there were times as she sat there when she was the Arnahwee of the Peary days. We joshed her about some of her many boy friends, and her face would light up as she would recall some amusing incident. All those who had passed on lived again in memory before her dancing eyes. What an hour it was! Could one have had all that in a motion picture, with her voice and expression recorded, you would have glimpsed her great personality.

Remembering her almost high-handed manner with the other Eskimos, I feared again how sorely she must have suffered at their hands in recent years. Poverty. None of these Eskimos are rich and a rough tongue is not the best old age insurance.

"Now I can no longer hunt *nanook* (polar bear), *oomingmak* (musk ox), *awick* (walrus) and *tuktu* (caribou)," she moaned. "I cannot even go off and spear the salmon and trout in the lakes near the village nor tend fox traps."

But her general appearance of well-being did not exactly jibe with my anxieties. She did not really appear at all needy. I became more and more curious to know how she managed to continue to dress so well, and finally I said:

"Arnahwee, you still know how to wear fine clothes. You are not poor, I can see. How do you manage so well?"

She smiled modestly. "These poor furs?" she said with the customary self-effacement of the Eskimos. "They are not so beautiful."

I gave her a sidelong glance to show that she could not put me off by denying what was obvious. "Tell me, now, how you do so well?" I urged. She grew more serious.

"I have always saved," she said. "Some Eskimos never think of tomorrow, and if something that someone gives them is not useful to them, they think it has no value. If I had not kept the things that were given to me from the days of Peary the Great, I would be in need, but by giving them out now I can have all I want."

The full meaning of her words was not known to me until I learned from others of our expedition that Arnahwee's igloo was full of picture books, magazines, china of all sorts, clothes, etc., the accumulation of years.

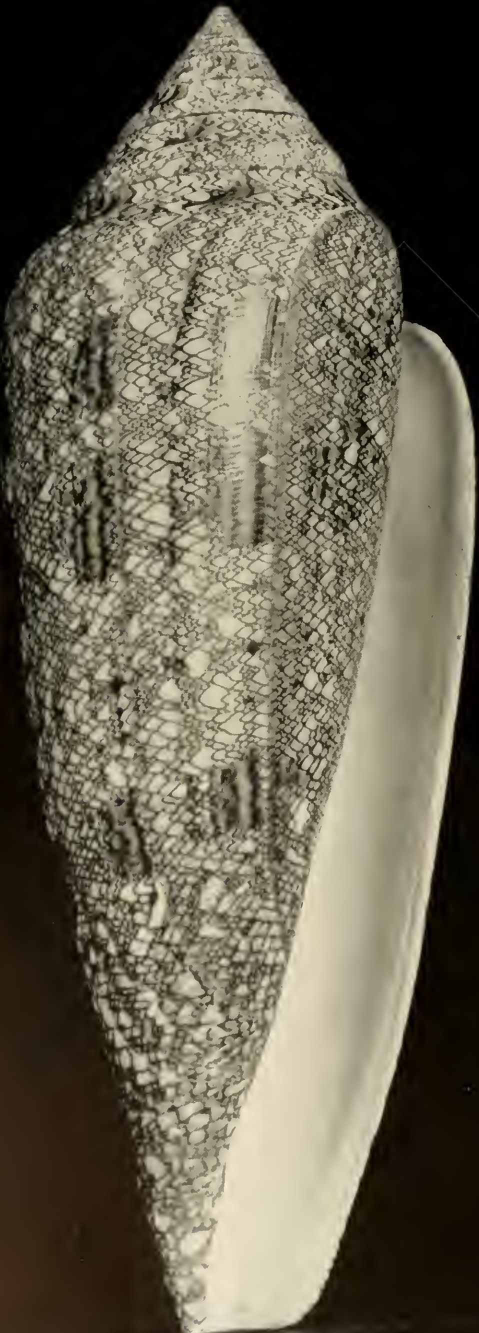
A match for anyone

So Arnahwee had come out on top. She had done just what a white person might have done before the days of pensions or social security.

Arnahwee deserves the best in her declining days, and as I sat there pondering over her rich philosophy I hoped that she had enough to buy her comforts as long as she should live. It was after she had left—that I began to feel really relieved about her. She had scarcely touched the food that we had prepared so bountifully, but though I am not sure whether she, Billy or I had packed up the food, I know that it all went with her. We had also made up a little surprise package for her. It was a pound of tea (special) that Mr. Graham Wright, President of Tetley Teas gave me for myself.

The last I saw of her she was sitting with a bunch of the children and others around her on the beach. No doubt she is regarded as a very wise though sometime cantankerous person among her people, and fortunate will be the young girls of her tribe who abide by her wise advice.

I value the small gift she made me—a pair of skin mittens. What a shock it would have been if the proud Arnahwee we all respected so highly had come to me a beggar. As it was, she still had her wits and was a match for anyone. What I fear most is that she may go blind. Our Doctor Soutter told me that it would happen in a year or two. It will be fine if she crosses the river before that happens.



What Is a Mollusk Shell?

By ROY WALDO MINER
Curator of Living Invertebrates

MOLLUSK SHELLS have always been of great interest to collectors. Because of the great number and variety of species, the remarkable diversity of form, color, and size, they have always attracted popular interest and have been fertile sources of motifs to students of design.

From the zoölogical viewpoint, the mollusks are one of the most important groups in the animal kingdom. Next to the insects they include more species than any other animal subdivision, approximately 80,000 being known. The phylum containing them is quite distinct from any other modern group, though the most primitive forms and the free-swimming larvae seem to point to an origin close to that of flatworms or platodes.

Paleontologically, they are one of the oldest groups, representatives being abundant among the fossils of the Lower Cambrian strata laid down at least 600,000,000 years ago. Their shells alone are preserved in a fossil state, but their abundance and the relatively high organization of all mollusks seem to indicate that they existed for millions of years previously, perhaps as naked forms incapable of leaving traces of hard parts in the rocks. It seems likely that the comparatively acid seas of early Pre-Cambrian times when the oceans were more or less free from the salts that accumulated in later ages by erosion from the continents, made the formation of shells of carbonate of lime impossible. Later, when the seas accumulated much calcium in solution, shells were formed, perhaps at first as one of the by-products of excretion, and later utilized and perfected as a means of protection.

The shell is the secretion of the mantle, a thin fleshy fold of tissue that surrounds the upper part of the mollusk's body. As indicated above, it is largely of carbonate of lime, and is laid down as a deposit on a base of delicate horny substance produced by the animal, and spoken of as *conchyolin.* The limy portion takes the form of crystals of calcite or aragonite, standing vertically, or laid down as delicate scales or laminæ slightly overlapping one another. Usually, the shell is composed of three layers: an outer layer of horny integument, rough in character, or raised in hair-like projections in some shells, in others a rough or smooth porcelain-like layer of vertical calcite crystals; beneath this a second calcite or aragonite layer with the crystals laid in another direction; and finally a porcellanous layer like the first. Shells that have an iridescent or pearly lining are usually the more primitive species. In such cases, the two outer layers are very thin, while the inner pearly layer takes up the greater thickness of the shell. This is composed of thin minute plates of calcite arranged horizontally with their edges overlapping like tiny shingles. The light diffracted from the close set lines produced by these edges causes the iridescent effect. The substance of this layer is generally spoken of as *nacre.*

Though the shell is often the most conspicuous part of the mollusk and the part most easily preserved in collections, it is really only a by-product of the animal, and biologically of secondary importance. It bears about the same relation to the animal as a suit of armor bore to a knight of the Middle Ages. If all we knew of a human being were the armor remaining from that period, it would bear somewhat the same relation as would our knowledge of mollusks, if the latter consisted merely in our acquaintance with their shells. The conchologists of the middle and latter part of the Nineteenth Century brought together huge collections of shells from all parts of the world, and, during that time, shell-collecting became a craze and was often the avocation of wealthy men. But the scientists of the time studied shells seriously and with great ability, so that our knowledge of their infinite variety, structure, and distribution advanced enormously, and gradually many facts became known concerning the animals that producéd them, as well as their anatomy and life history. Nevertheless the classification of mollusks was based at first almost entirely on their shells and many errors were made that were gradually corrected in later years, when our knowledge of their soft parts was increased. The present-day student of mollusks investigates the animal itself as well as the shell, and gathers all possible facts that will make our knowledge of this group as exact and exhaustive as possible.

From the economic standpoint, mollusks have always been of the greatest importance to the human race. The bivalves, or two-shelled mollusks furnish an enormous food-resource, while the gastropods or single-shelled, snail-like forms, as well as the squids and octopuses, have contributed their part, though to a lesser degree.

The oyster, clam, and scallop fisheries are by far the most important. Millions of dollars are invested in their development, and thousands of men and great numbers of vessels are employed. Mussels, cockles and razor-shells are also eaten, especially in foreign countries. Among the gastropods used for food in various parts of the world are periwinkles, whelks, conchs, and the luscious abalone. Many other forms are consumed locally by the natives of different countries where they are plentiful.

For other economic products than food the pearl-oyster is of outstanding importance, not only for the precious pearls occasionally produced, but also for the mother-of-pearl, which is used extensively for the manufacture of buttons, knife-handles, inlays, and all kinds of fancy ornaments. All nacreous shells of other species have varying value in this respect, the most important being the fresh-water clams, abalones, top shells, and the turban-shells. Certain cowries have been used for money in the Far East and the Pacific Islands, while the American Indians used shells of the hard clam for making wampum. The tusk-shell also was utilized for this purpose by the Indians of the northwestern states. Shells have been used for various utensils, such as spoons, knives, dishes and basins. Tritons and conchs have been widely used as trumpets. The Purple Snails were crushed by the ancients and by many native Indian tribes for purple dye. Shells are ground up for road-making and are burned to obtain lime. Many of the beautiful species are used for ornaments such as necklaces, shield-decorations, earrings and the like. The great Orange Cowry is highly prized as a mark of rank of Fiji chieftains. The larger and more beautiful shells are doubtless used by many of our readers as household ornaments and curios and shell-collecting is progressively becoming of widespread general interest.

The mollusks are classified in five main groups, as follows:

The *Amphineura* or Chitons and their relatives. These are the most primitive of living mollusks, the larger number of them having an oval, creeping body with a jointed armor of eight transverse plates. They have a certain serial repetition of body-parts and breathe by means of a double row of plume-like gills.

The *Gastropoda* or snails. This is the most important group in number of species, distribution, and extent of diversification. They are the most ancient from the standpoint of fossil remains. The earliest shells resembled a "liberty cap," being cone-shaped with the shell uncoiled. Soon forms appeared with a one-sided roll; and a little later the spirally twisted, right-handed shell was established and has been generally characteristic, ever since. The twist of the shell is reflected in the internal anatomy. In some gastropods the shell has become reduced, and in others it has disappeared entirely.

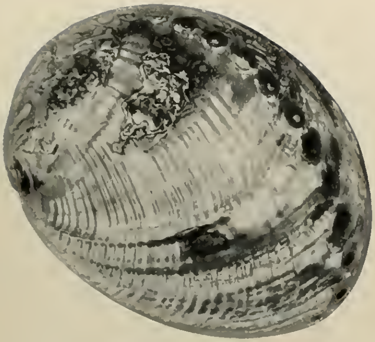
The *Scaphopoda* or Tusk-Shells are relatively unimportant comprising only a few species. They possess a shell shaped like an elephant's tusk open at both ends.

The *Pelycypoda*, or bivalves, have the mantle divided into two halves each of which secretes a shell. They are hinged together and are nearly equal in size. The foot is flattened vertically and extends down from the enclosed body-mass. It may be protruded from between the two shells for digging or swimming. Delicate, flattened and fine-meshed gill-flaps on either side furnish breathing organs and an arrangement for filtering out food-particles.

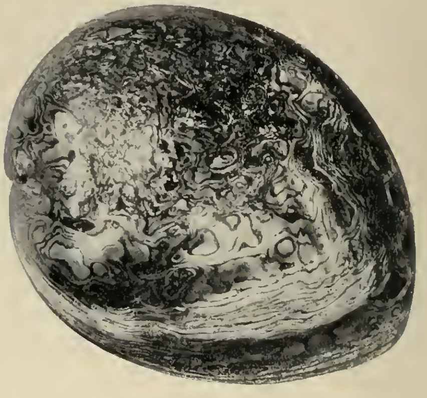
The *Cephalopoda* include the swiftly moving squids, cuttlefishes, and octopuses. This highly organized and specialized group is composed of predacious species with efficient eyes and method of propulsion of a peculiar kind. The Pearly Nautilus is the most ancient type. It is illustrated and described elsewhere in this article. The shell is well-developed in this species, but shows progressive degeneration in most of the squids where it becomes internal, and practically disappears in the octopuses. Thus the members of the group are freed from hampering armor to make possible a vigorously active life.

The American Museum of Natural History has an unusually extensive exhibition series of shells displayed in the Hall of Ocean Life. The following photographs illustrate a few outstanding examples taken at random from the Museum shelves.

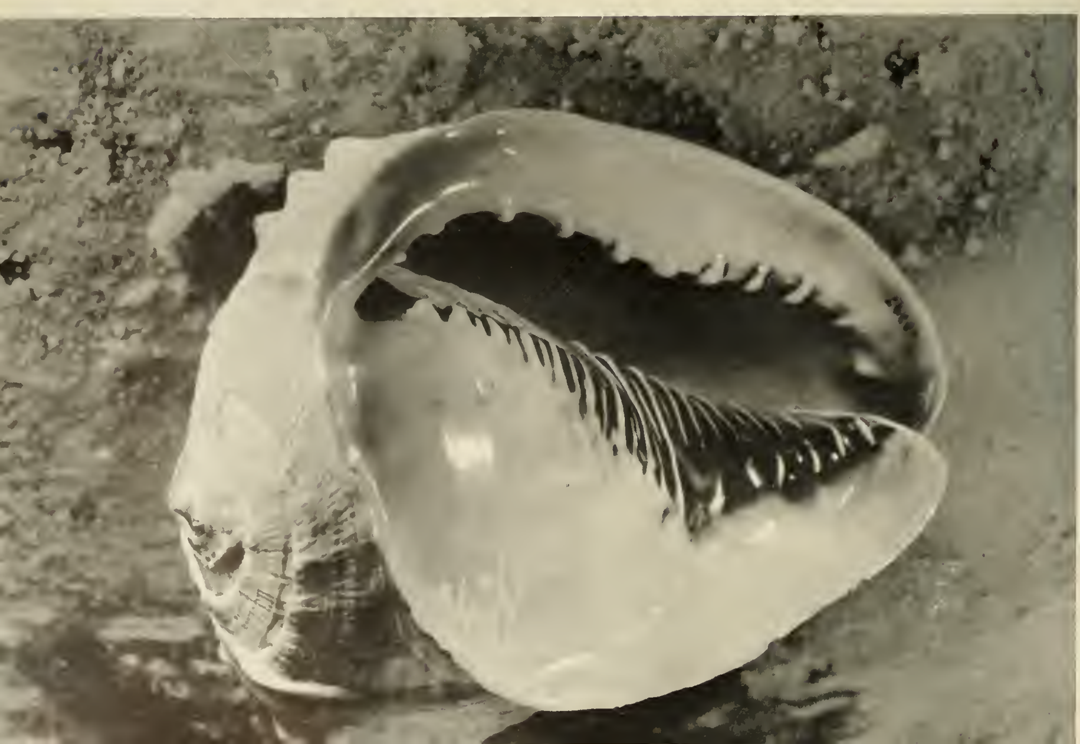
(Left) THE GLORY OF THE SEA (Conus gloria-maris). *Enlarged two diameters. This is the rarest and most sought after of shells. It is practically extinct as no specimens are recorded as having been seen alive since 1838, when Hugh Cuming of the British Museum found three specimens on a reef in the Philippines. Not more than a dozen specimens are known to exist and have always commanded high prices. There are two perfect specimens in the collections of the American Museum. The tapering shell suggests an unfolding rosebud. Its porcelain-like surface of pure ivory is completely covered with a mosaic of thousands of tiny triangular figures outlined in chrome yellow or deep chestnut. Three broad spiral bands of orange encircle the body and, in certain lights, the whole shell is suffused with a faint rosy sheen. The specimen illustrated is five inches in length and was collected in the Moluccas*

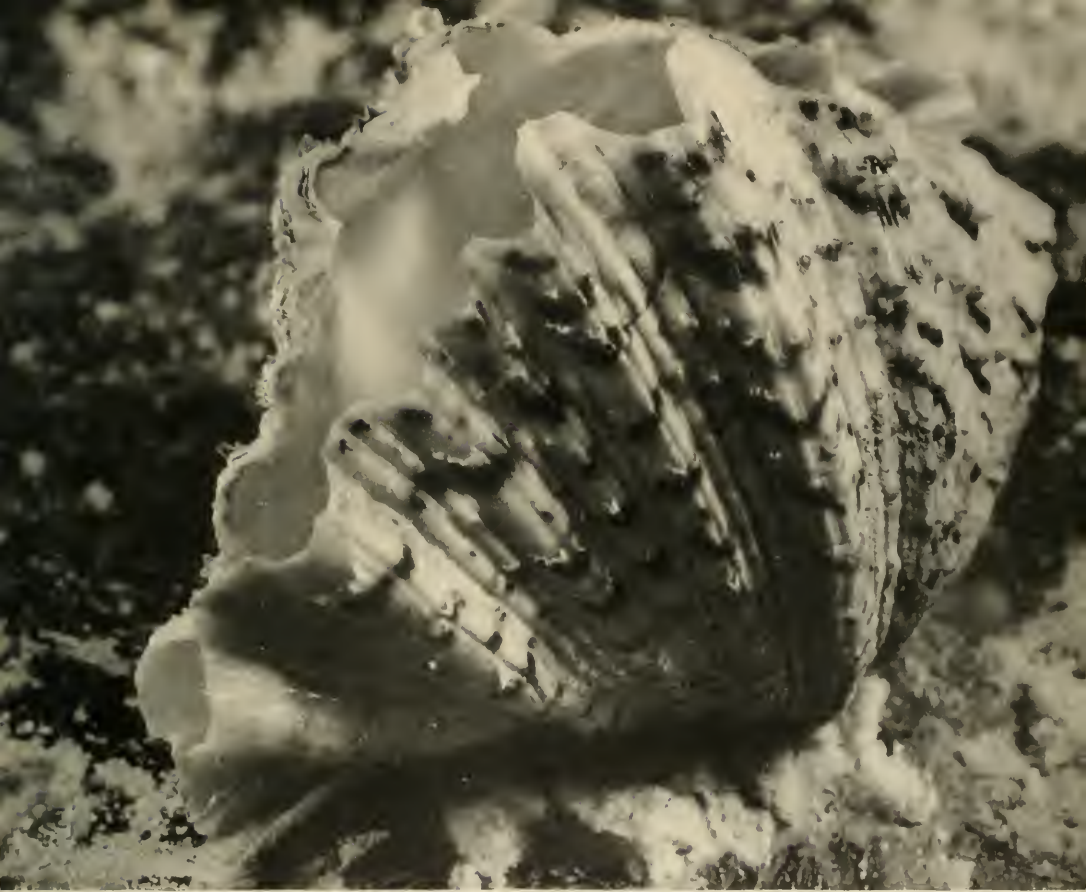


A SERIES OF POLISHED EAR SHELLS *(Haliotis sp.)*. The series of shells crossing the pages diagonally illustrates the varying surface character of different species of ear shells or abalones when the rough outer layer has been polished off

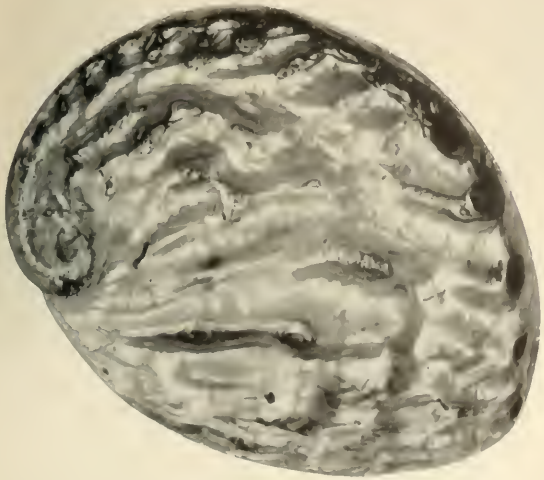


(Below) THE CAMEO HELMET SHELL *(Cassis madagascariensis)*. This shell is not an inhabitant of Madagascar as the scientific name implies. This was due to a mistake of Lamarck, who named it. It ranges along the Atlantic coast of the United States from North Carolina southward and throughout the West Indies. It is one of the largest of our marine snails and was of great commercial value for cameo-cutting when those delicate shell-sculptures were the vogue. Now they are no longer in style and the demand for cameo shells is at an ebb. The shells were formerly exported to Italy and France where the white outer layer was cut into bas relief in skilfully wrought figures standing out against the rich dark brown background of the exposed inner layers of the shell. Ancient cameos were cut in semi-precious stones during classical times. It was not until the early part of the nineteenth century that shells were used for this purpose. The Queen Conch *(Strombus gigas)* was also used to make pink cameos on a white background



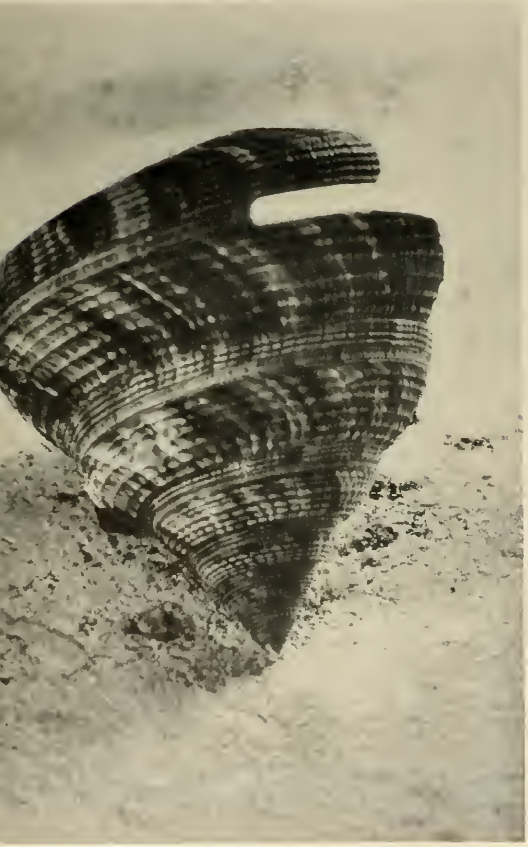


(Above) The Bear's Paw Clam *(Hippopus maculatus)*. This is one of the most graceful and fascinating of bivalve shells. It is native to the seas of the Far East, where it is abundant on coral reefs. Both valves are sculptured with a series of rounded and fluted ridges separated by alternating grooves curving over the highly arched shells. These are ornamented with rows of leafy projections and irregular bands of purplish rose rising over the pure white ridges and dipping into the yellow valleys between. The scalloped shell margins neatly interlock as they come together

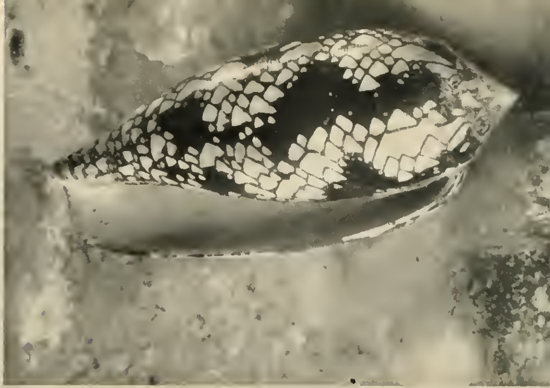


The polished surface of the abalone, as shown by the three diagonal photographs, may be wavy with scattered flutings, comparatively smooth, or thrown into fine parallel ridges. Note the differences in the curving of the spire. The color is a changing iridescence on a background mottled blue to peacock green, red and silver, and broken rainbow hues. The lines of the color markings make extremely interesting and often complicated wave patterns. These features are carefully utilized in cutting up the shells for commercial ornaments

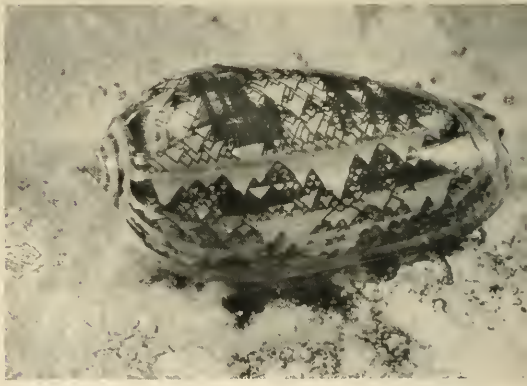
(Below) THE FAMOUS SLIT SHELL *(Pleurotomaria beyrichi)*. This rare shell belongs to a genus once supposed to be entirely extinct, but since 1860 occasional specimens have been dredged alive in deep water in the West Indies and near Japan. It is remarkable for the broad slit extending partly around the outer whorl. As the shell grows this closes from behind. The trail of the closed slit may be seen extending around the spiral of the shell. This photograph (natural size) is of an unusually fine specimen richly colored yellow and red. Fossil specimens occur abundantly since the Cambrian, 600,000,000 years ago



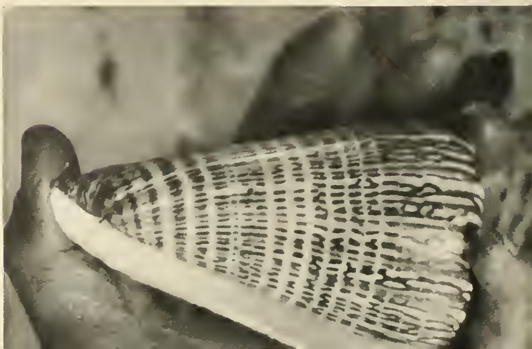
THE THOUSAND-DOTTED CONE *(Conus millepunctatus)*. This cone from the East Indies is completely covered with thousands of close-set brown dots on a white background. Because of their irregular arrangement they resemble characters of some inscribed writing. The spire is quite flat. It is one of the common cones of the Far East. The specimen represented is about five inches in length



(Above) THE MARBLED CONE SHELL *(Conus marmoreus)*. An extremely showy species from the China Seas. The triangular markings are creamy white, the background dark brown. Like all cone shells it has a poisonous bite. A tapering proboscis contains two bundles of tiny hollow teeth, each with a poison gland. A painful wound my be inflicted on the hand that picks it up

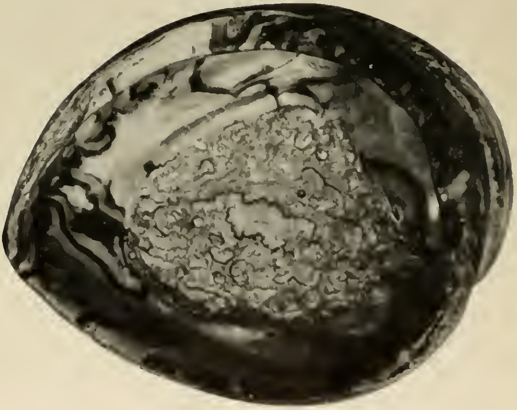


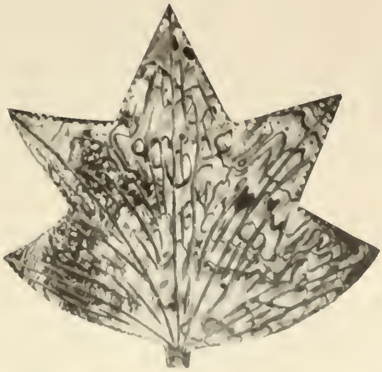
THE PORPHYRY OLIVE *(Oliva porphyria)*. The olive shells have a much shorter spire than the cones and much more rounded shoulders. The outside is like polished porcelain produced by reflected folds of the gay mantle which adorns the outside of the shell in life. The surface in this species is covered with crowded tent-like markings in brown, so it is often called the "Camp Olive." (Gulf of Mexico)

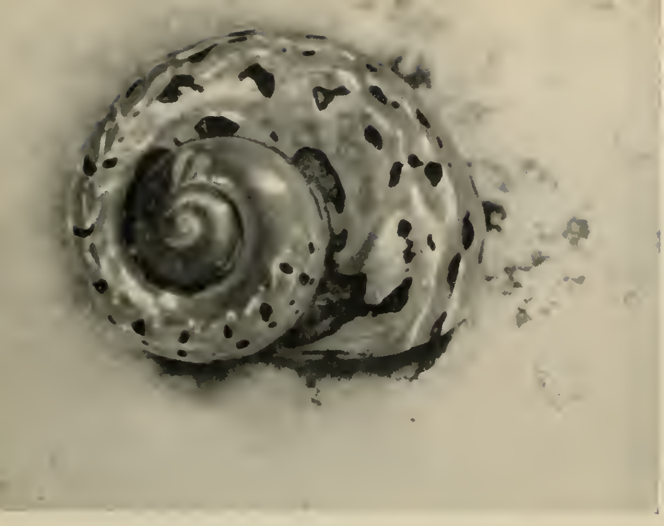


The Splendid Abalone *(Haliotis fulgens)*. The abalones are also called ear shells because of their shape. There are many species of them found on rocky shores and distributed widely in California, Lower California, Indian Ocean, Australia, Japan and Africa, with one small species in Europe. They are remarkable shells, often of large size, the specimen here illustrated being eight inches in length. The outside is rough with a low coiled spire so that the shell looks like one valve of a clam-like mollusk. Nevertheless it is a true gastropod with but a single shell. The animal has a broad foot enabling it to cling closely to a rocky surface and is pried away with difficulty. The shell has a row of from five to seven round openings along its outer margin allowing a corresponding number of tapering gill-filaments to project from them. Continuing this row is a series of sealed-up openings that were utilized when the shell was younger and were closed as the animal grew. The inside of the shell is lined with beautifully marked mother-of-pearl of peacock green, including the large muscle scar wonderfully patterned in changing iridescent hues. If the rough exterior is ground or etched away, the shell becomes a marvelous object of polished changing sheen. It is utilized extensively for mother-of-pearl ornaments like those shown at the right. Many "abalone pearls," irregular in shape, are found within certain shells and make beautiful objects for which there is a ready sale.

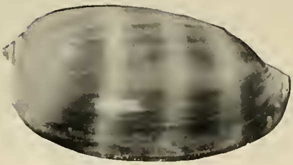
The flesh of the abalone is marketed extensively in China and Japan and is also popular in California for delicious soups, chowders, and "abalone steaks"



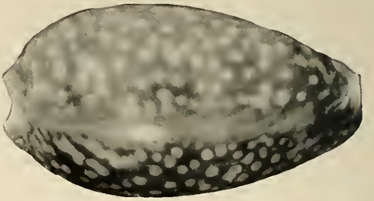




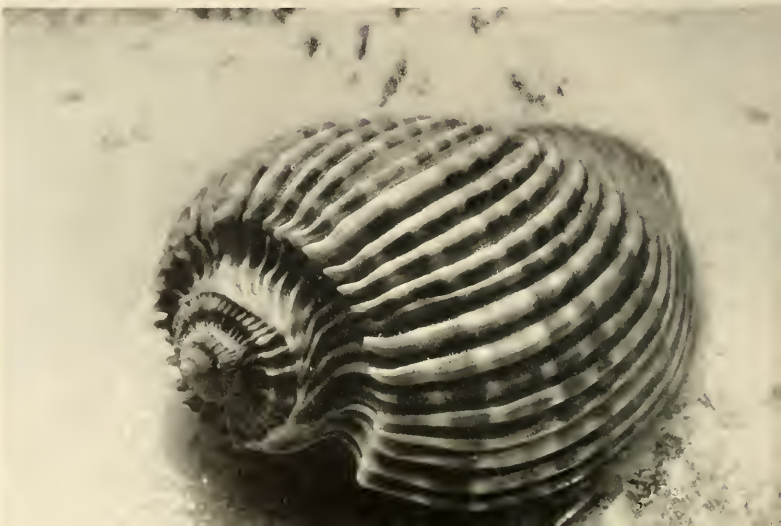
THE TURK'S CAP SHELL *(Turbo sarmaticus)*. This is a member of the group of Turban Shells to which the Green Snail *(Turbo marmoratus)*, shown on p. 409, also belongs. The species shown at the left is abundant at Cape Town, South Africa, where it forms an important article of commerce. The outside of the shell is brownish red and comparatively rough in the natural state, with a layer of black underneath, but this thin coat can be readily ground or rubbed off, leaving the entire shell of a beautiful pearly lustre with translucent greenish clouds. The shells are cut to adorn various articles such as knife handles, purses, cigarette cases, card cases, as well as various forms of jewelry

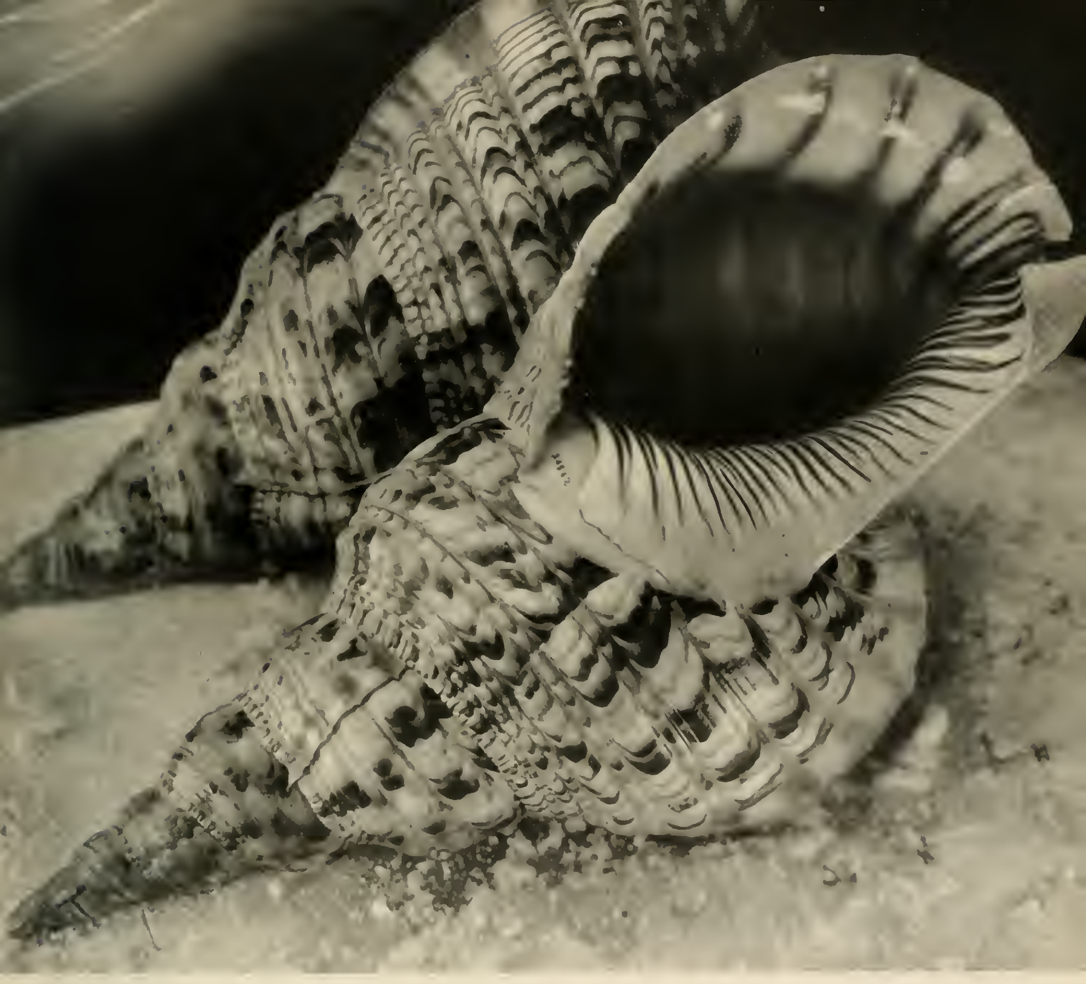


(Left and below) THE MEASLED COWRY *(Cypraea exanthema)*: The common cowry of the West Indies. Usually patterned with light round spots on a chestnut ground having bluish gray clouds. Some specimens are entirely without spots like the shell to the left. Often found crawling up mangrove stems in Southern Florida and Bahama swamps. Like other *Cypraeas*, the polished shell is due to the action of the reflected folds of the shell-forming mantle which covers it in life



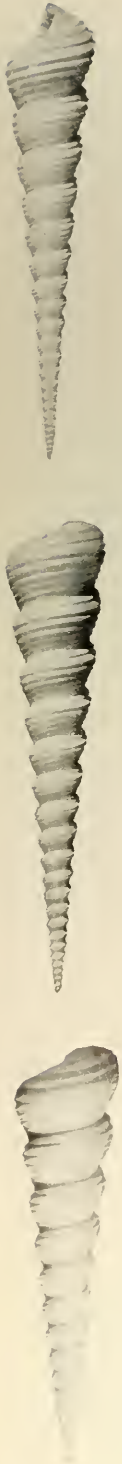
(Below) THE IMPERIAL HARP SHELL *(Harpa costata)*. The graceful shape of this beautiful shell suggests the name applied to it and its relatives. Naturally polished by the mantle of the animal, and variegated with rich coloring heightened by the bright orange of its lining, it is one of the most attractive of mollusks. This species is distinguished by close-set prominent ribs

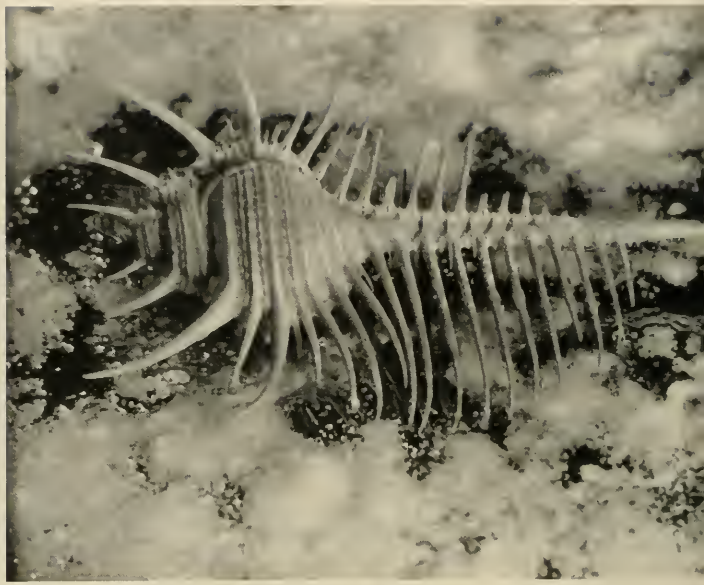




TRITON'S TRUMPET *(Triton tritonis)* This shell sometimes grows to 18 inches in length. Its graceful form suggests a trumpet, for which purpose it has often been used by cutting a hole at the tip of its spire. It is remarkably colored with purple, brown, and reddish crescents on a light ground, each crescent just occupying a whorl width, and giving the effect of a gayly colored bird's plumage. At intervals along the spire may be seen the sharp edges of "varices," the former lips of the shell-opening when growth was arrested in successive stages of its life-history. The shell above was photographed in front of a mirror to show both sides

THE ORANGE COWRY *(Cypraea aurantium)*. This brilliantly polished richly orange-colored cowry is prized by collectors both because of its rarity and beauty. It is found outside the reefs in deep water in such Pacific Islands as Fiji, the Solomons, and the Loyalty Group. Among the natives the wearing of these shells is considered one of the highest honors to be conferred by a chief, paralleling an Order of Merit among European nations

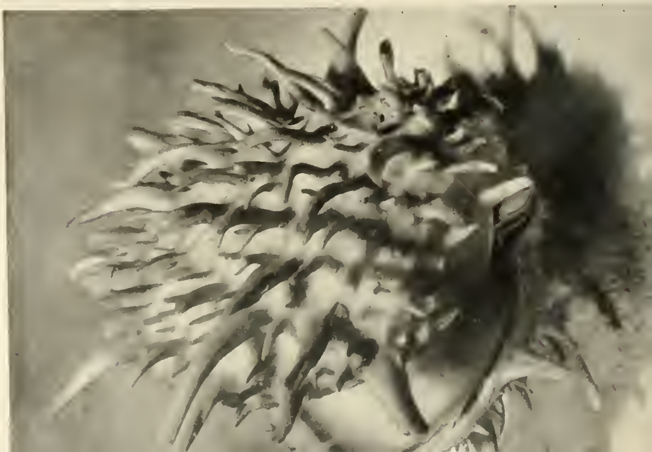


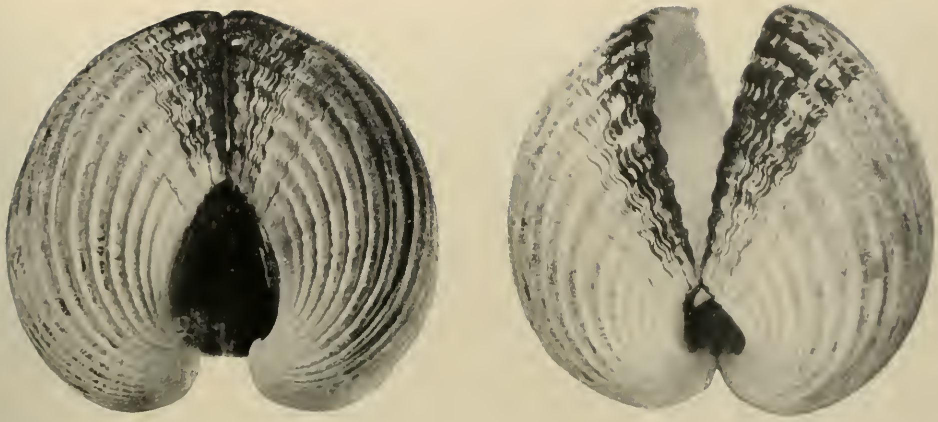


(Above) The Venus's Comb Shell *(Murex tenuispina)*. The Family Muricidae, to which this remarkable shell belongs, is a large one containing many species of highly organized, carnivorous mollusks spread throughout the world, especially in warm seas. Many of the species are characterized by grotesque or graceful spine formations. The slender lower shell-margin is extended forward to form a long "canal." Six varices, each with a row of delicate attenuated spines, give the name of the shell. To this same family belong several species of *Murex* or *Purpura* which produce a beautiful purple dye from the anal glands. It was *Murex brandaris* of the Mediterranean that furnished the Tyrian purple dye of the ancients and the royal purple of the Roman emperors

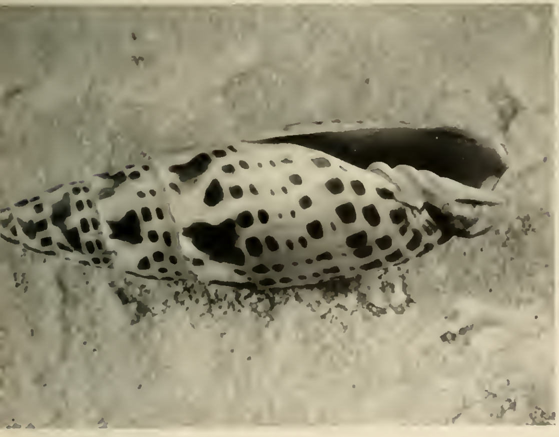
(Left) The Great Screw Shell *(Turritella terebra)*. The gracefully turned spires shown at the left taper to a sharp point and sometimes attain a length of five inches. They are found in the Philippines and the Far Eastern Seas. It is said that such a shell suggested to Archimedes the principle of the screw

(Below) The Painted Thorny Oyster *(Spondylus pictorum)*. The genus containing these strange and beautifully tinted bivalves has been known since the time of the ancient Greeks, and they have always been favorites with shell collectors. They inhabit tropical seas. The species shown below comes from Lower California. Its spines are rose red and often orange or yellow



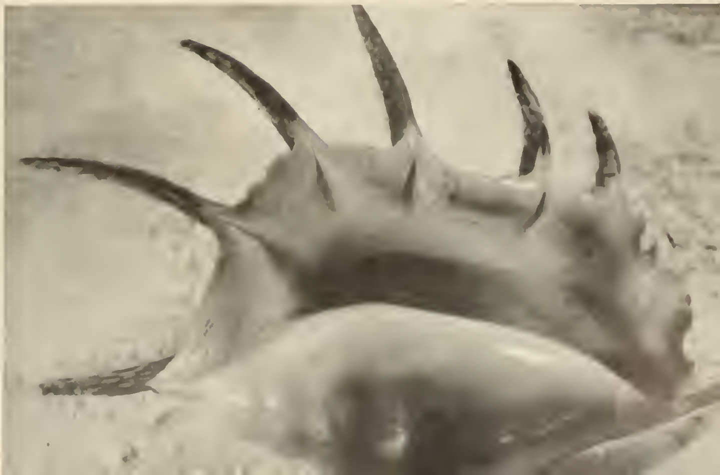


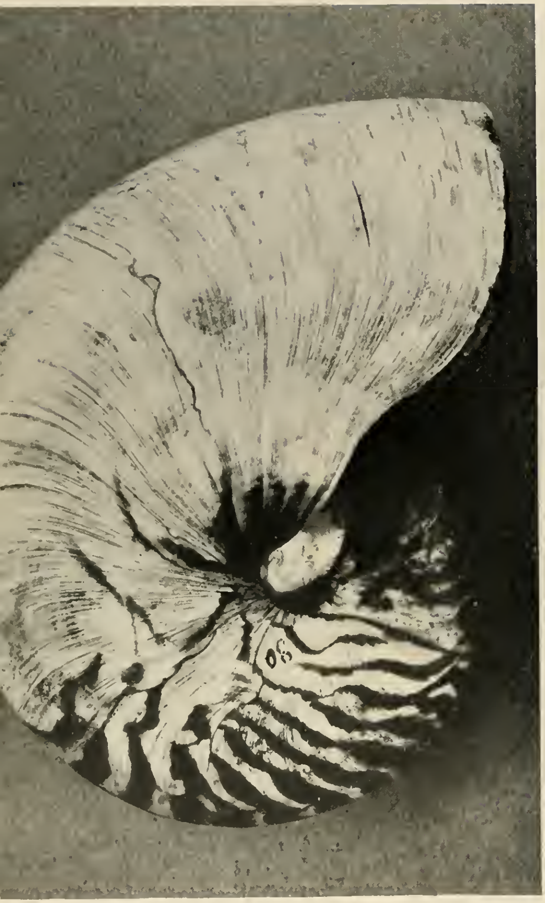
The Great Ark Shell *(Arca grandis)*. The heavy box-like valves of the ark shells give their name an appropriate significance. There is a strong bristling epidermis on the outside. The shells fit together closely, their thirty or more ribs interlocking. The hinge is very long and has a large number of teeth in comb-like series. The valves are strongly arched with curving beaks separated by triangular excavations spreading to the hinge. Viewed edgewise a lateral extension of this area has a heart-shaped outline. (Common from Cape Cod to the West Indies)

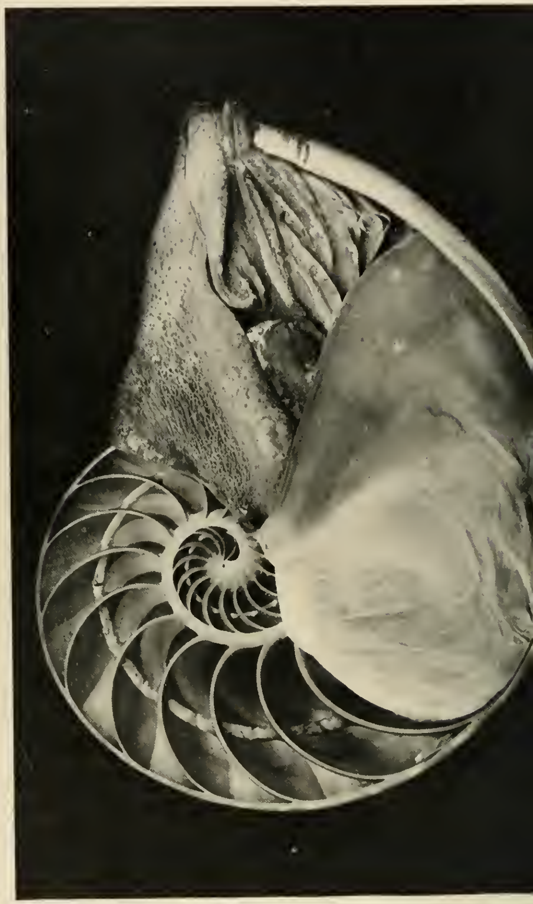


The Episcopal Mitre Shell *(Mitra episcopalis)*. The Mitre Shells are widespread in tropic seas. There are more than 200 species, many of them brightly colored and much sought after by collectors. The Episcopal Mitre shown here has a white porcellanous shell. The closely compressed whorls form a graceful tapering spire with slightly convex outlines. It is conspicuously marked with bright orange spots nearly quadrangular in shape and neatly arranged in rows, except for those directly under the sutures of the whorls which are large irregular blotches. The shell-opening is streamlined with the general curvature of the spire, and several large "teeth" adorn the columella or central stem

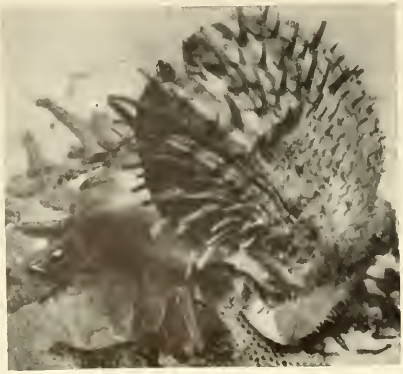
The Spider Shell *(Pterocera bryonia)*. This strange shell is related to our West Indian Queen Conch *(Strombus gigas)*, but is native to Tahiti. It is massive, often a foot in length. The outer surface is rough, but the lining is beautifully enameled with rose blending into orange. The long pointed projections from the edge of the shell-margin at first hollow but later becoming solid, grow out as the shell attains the adult condition and when it is moving over the sea-bottom it suggests the appearance of a huge spider





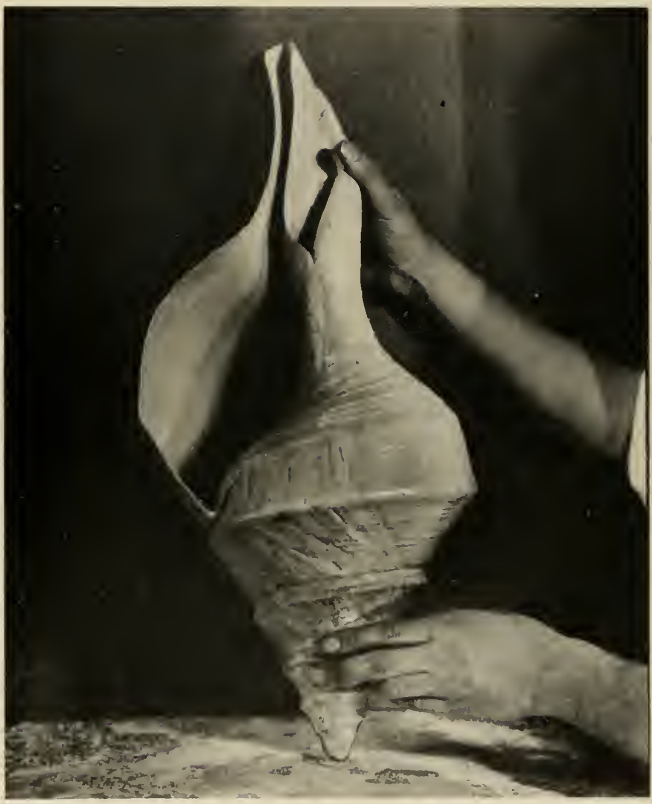


THE PEARLY OR CHAMBERED NAUTILUS *(Nautilus pompilius)*. This remarkable creature belongs to a bygone age. It is the only surviving species of a long line of fossil forms reaching back 500,000,000 years or more. It is a member of the Cephalopoda, the group which includes the squids and octopuses. The outer layer of shell is porcellanous, pure ivory in color. Otherwise the thickness of shell is mother-of-pearl of a most beautiful lustre, much used in manufacture of fancy articles. Within the hollow coil of the shell there is a succession of cup-shaped chambers diminishing in size until the smallest and earliest formed is reached at the center. The animal, with its many tentacles, lives in the outer chamber, as seen above at the right



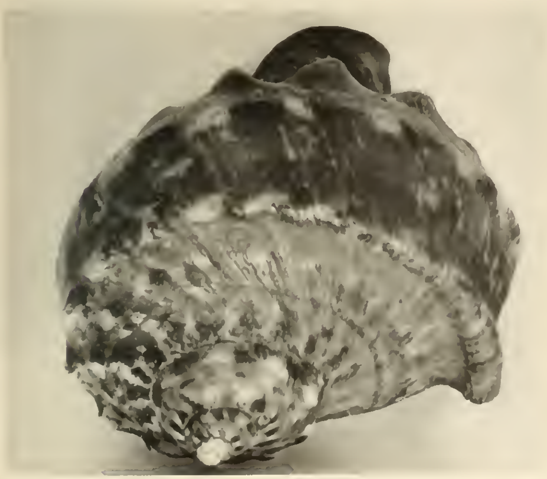
(Left) The lower valve of this *Spondylus* or Thorny Oyster has become attached to the branches of a cluster of dead coral

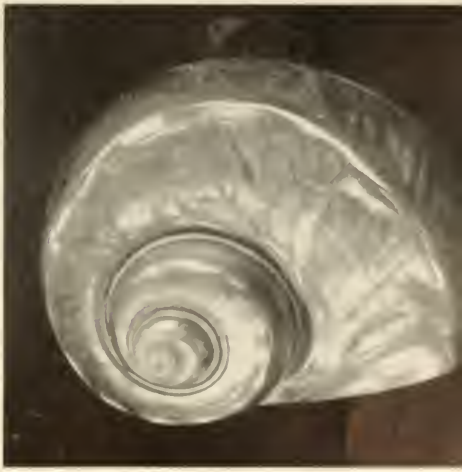
(Right) NORTHERN SCALLOP *(Pecten islandicus)*, first discovered in Iceland, whence its name. Most brightly colored of the scallops, it is banded in red, orange, purple or pink



THE SPINDLE SHELL *(Fusus proboscidiferus)*. The Spindle Shells are found in warm seas and all are huge shells. The species shown is the giant of them all, at times reaching a length of two feet. The whorls of the spire are bordered with knobbed ridges. The shell tapers to a long open canal which is undulate and slightly bent to one side. Another open tube, the umbilicus, penetrates the spire and runs parallel to the canal above mentioned. The color is light brownish yellow and the outside is often covered more or less with a silky epidermal coat. This specimen came from Australia

BEFORE AND AFTER POLISHING: The Green Snail *(Turbo marmoratus)*. This is the largest of the Turban Shells. It is characterized by the horny outer layer of green, variegated with brown and whitish blotches. When this is ground off, a beautiful greenish pearly lustre is exposed, brightened by rainbow tints. Early Scandinavian kings used these shells for drinking horns. Examples have been preserved elaborately mounted in silver and adorned with jewels. The shoulders of the low spire are raised in a heavy ridge, and a row of large knobs stands out on the lower part of the body whorl, as shown to the left below. To the right is a fine specimen which has been ground to show the mother-of-pearl beneath. These shells are abundant in Eastern Seas, and the animal is used for food in Japan





THE TWILIGHT OF THE INDIAN PORPOISE HUNTERS—*Petroleum took the profit out of porpoise oil forty years ago; but one 74-year-old veteran in Western Nova Scotia remained to perform a dramatic reënactment of this perilous profession*

By ALEXANDER H. LEIGHTON

SOME years ago, when I was a child, a reminiscing Bay of Fundy fisherman told me a remarkable story. He said he had been a cabin boy on a coastwise schooner that was beating up the bay one windy afternoon in 1885. It was a blustering day of sudden gusts and heavy sea, with no land visible. One of the sailors, who was gazing idly over the side, suddenly called his attention to the astonishing sight of two red Indians in a long canoe. The fisherman said that at first he thought they were ghosts, for they soon vanished behind the high waves. But they appeared again nearer, paddling against the wind, working desperately, and drifting backward.

An unforgettable story

They made a strange picture, these men from nowhere, suspended between gray sky and gray sea, fighting for their lives.

They were hailed and taken aboard and, although properly grateful, were less concerned about their predicament than were the sailors. They said they were porpoise hunters who had been swept out and down the bay by the wind. As evidence they showed three porpoises in their canoe and, out of gratitude, presented one of them to the sailors. Throughout the evening the Indians squatted together in the forecastle talking quietly in their own language.

The next morning was calm and sunny, and despite all protests the Indians put their canoe overboard and paddled away on a gleaming sea unfringed by land.

The singular image of those two Indians who put away from the schooner in the morning sun has long remained in my mind. It aroused in me a curiosity to find out more about them and their porpoise-hunting trade. This curiosity was left unsatisfied until the summer of 1936, when, having two months to spend near the Fundy coast, in Digby and Annapolis Counties, Nova Scotia, I visited the Micmac Indian reservations.

My research into their past was not difficult, for when I talked of porpoises, old Micmac eyes grew dreamy as they saw the blue rip-tides of other days. Muzzle loaders came down from walls, powder horns were picked up from dark corners and I was told of chases on the Bay of Fundy, of storms and fogs and fighting animals of the ocean.*

Birth of porpoise industry

These Micmacs are a tribe of Algonkian linguistic stock, who used to dwell inland during the snow months hunting moose and caribou. But according to the present generation, they always had the custom of coming to the coast in summer to fish, spear salmon, and smoke their catches for winter consumption. It was not, they say, until about 100 years ago that porpoise hunting was first practised by their tribe. Legend has it that at this time the Grand Manan Indians came over to the Micmac shores and instructed them in the new craft.† The Micmacs at that time had very little contact with the white people and were unaware of the existence of a good market for the oil. Once this was learned, every able-bodied male Indian took up the hunting.

Some time between early May and late June, the Micmacs would leave the forest and come down the rivers. Often a flotilla of twenty-five birch bark canoes passed through the rippling waters of Digby Gap and, amid the sounds of laughter and barking dogs, would head along the coast to a cove where there was shelter and drinking water. These canoes were about twenty feet long and capable of transporting an entire family with all its household goods. They carried rolled sections of birch bark in their canoes, which, on landing, were unravelled and set up on poles to form a conical dwelling similar to the western teepee, each piece of bark having been previously cut to fit in a particular place. Beds of fragrant fir and spruce were laid on the wigwam's damp earthen floor, but, even though a smoke opening was left at the top of the wigwam, no fires were burned inside during the summer. Instead, one large communal fireplace was built out of doors. As soon as the wigwams were finished, the village settled itself for two and a half months of porpoise hunting.

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* My principal informants were Levi Brooks, Malti Picton, Louie Peters, Louie Harlow, Billy Meuse, John Meuse, Peter Michael, and especially Matthew and Mary Pictou, and Joseph Lewis and his wife, all of Bear River. At Lequille, Mary Mitchel and Jim Pictou and his wife were of help. I also asked questions among the white people to check the Indians' statements, and here received a great deal of information from Mr. L. V. Shaw of Clementsport, Doctor Baily and Doctor MacIntosh of the New Brunswick Museum.

† It may be that contrary to the opinion of the Indians living today, the craft of killing sea mammals was known to their race in much earlier times. Doctor MacIntosh of the New Brunswick Museum has pointed out to me the occurrence of whale hunting in Rand's *Legends of the Micmacs*.

While the men were at sea the women played various simple games, did a little quill work, or caned chairs and made baskets, especially if there was a white settlement near by.

On fine days the men hunted; on windy and wet days they boiled blubber. Matthew Pictou, who was my chief informant among the Indians, said that he had seen the carcasses of 60 porpoises lying along the kelp-strewn beach, ". . . and wasn't that a Gawd-Jeeseley stink!" the old fellow exclaimed. Some men got reputations for being great hunters. Malti Pictou, a relative of Matthew and now ninety-nine, was one such. His pinnacle of fame came when he killed four hundred porpoises in one summer. He also claims that he has taken blackfish, white whales, and seals.

The hunt

The method of hunting was simple and direct. Two men put out in each twenty-foot birch bark canoe. The canoes were the usual Micmac shape, no up-curl to the bow and stern, and therefore fine for open and windy water. There were no seats. The bow man knelt and leaned back against a thwart, and while the stern man sometimes sat at the back where the gunwales came together, he usually slipped down on his knees when any exertion or skillful work was required. The bow man was equipped with a ten-bore, long-barreled muzzle loader called a "porpoise gun", and a twelve-foot spear. The gun was an instrument with a terrible kick, and the shot used was very coarse, larger than buckshot. Powder horn and shot bag were kept close by. The spear was fixed with the butt caught under one of the middle thwarts and the point projecting beyond the bow. Thus it could be quickly seized. It was really a gaff, the sharp part made of iron, about a foot long and barbed at one end, and at the other fitted into a light spruce shaft of eleven feet or more.

Out on the sea the canoes went their way fairly individually. To keep together increased the danger of shooting each other. They set forth on the rising tide and met the porpoises coming in toward the rivers and estuaries in pursuit of herring and mackerel. As soon as a porpoise rose close enough, he was shot and then transfixed with the spear before he could escape or sink. The spear was never thrown, but held by the bow man, who rode his canoe like a horse and used the spear like a boar hunter. In a rough sea with a wild porpoise, both bow and stern man had to fight hard to keep the canoe right side up. To capsize miles from land, in water chilled by the Labrador current, would have been fatal. When the porpoise was dead he was pulled in over the side by the Indian at the stern—another difficult job, even in calm weather. The usual day's catch was about six porpoises per canoe, but some men could get as many as twelve and come home with their gunwales almost awash.

From blubber to oil

When the chase was over the porpoises were thrown on the shore at the water's edge and stripped of their blubber and whatever meat was desired. The rest of the body was left for the sea to claim. After drying, the blubber was boiled into oil and put into kegs. When enough had accumulated, a canoe load was taken to Digby and sold. Some was sent to St. John to wholesale houses; but a good deal was used locally. Without further refinement it was suitable for machinery and leather. The Indians themselves employed it on leather, for a laxative, poured it in their ears for ear-ache, and baited bear traps with it.

About the middle of August the wigwams were dismantled, the bark sections packed and the canoes, loaded with Indians, children and dogs, returned up the rivers to the inland waterways, to catch eels, and smoke them for winter use.

As I listened to the words about these things and saw that my informants were all old men and women, I realized that the craft and knowledge of porpoise hunting in Nova Scotia was as close to the grave as they were. I have been told that on the north shore of the St. Lawrence, sea mammals are still hunted and their oil used, but in Nova Scotia none of the younger Indians knew any more about the work than I did. The hunting had stopped, they said, in the early part of the twentieth century when the coming of petroleum oils forced the price so low that it was not worthwhile chasing the porpoises. I was, therefore, talking to the last of the porpoise hunters, and in a few more years nobody

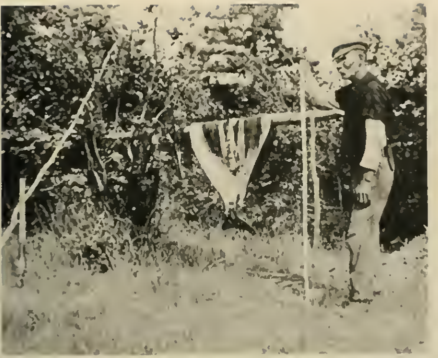
The Twilight of the Indian Porpoise Hunters

Farewell to Birch Bark: a modern Micmac Indian making a canvas canoe. In former years when the porpoise oil trade flourished, a flotilla of 25 birch bark canoes could often be seen skimming through the rippling waters of Digby Gap, Nova Scotia. The following series of photographs illustrates a reënactment of this perilous hunt by Matthew Pictou, 74, the only remaining porpoise hunter among the Bear River Indians

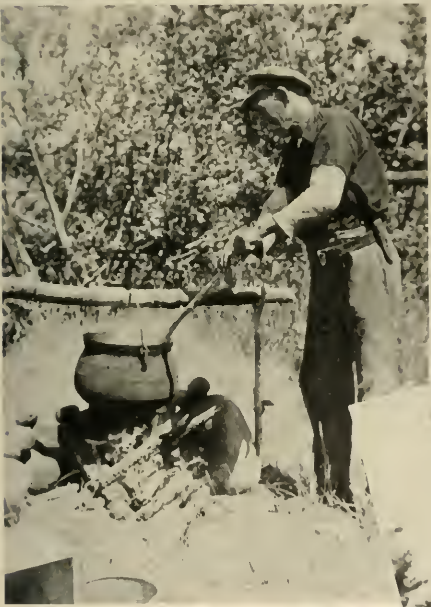
"This ain't the first time I've been on this old bay," said Matthew Pictou, slapping the sides of his thirty-year-old bark canoe. Matthew's spirits rose to the chasing of sea monsters as of old

The catch: with gun and spear the old Indian proved he had lost none of his skill. Not least difficult is the task of balancing the canoe while hoisting the heavy porpoise on board

Sixty porpoises sometimes lay on the beach at once in the old days and one Indian is known to have killed 400 in one summer. Early in the 20th century cheap petroleum removed the last means by which the Micmacs could apply their hunting ability to the economic order of the white man

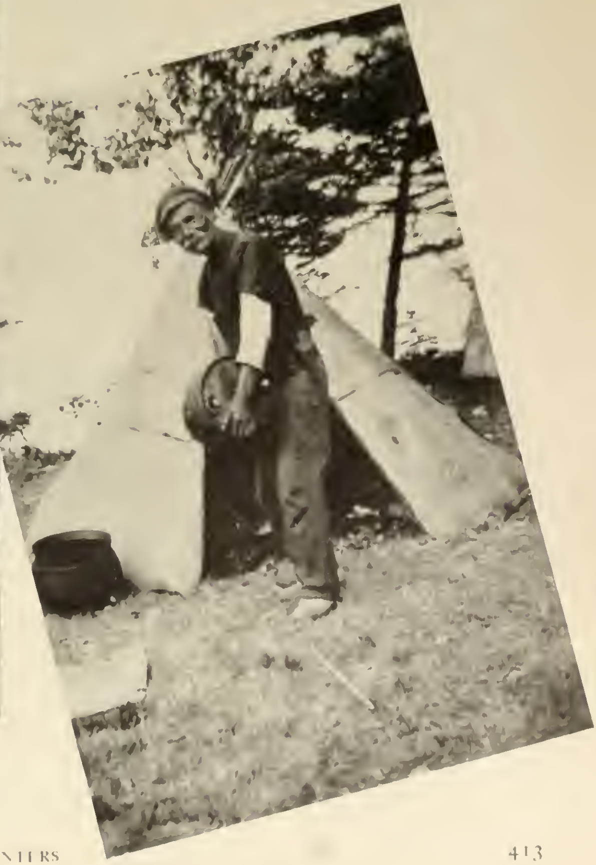


MATTHEW PEALED THE SKIN and blubber away from the spine and hung it up to dry. The flippers, the lower jaw, and the flukes were left attached to the sheet of fat

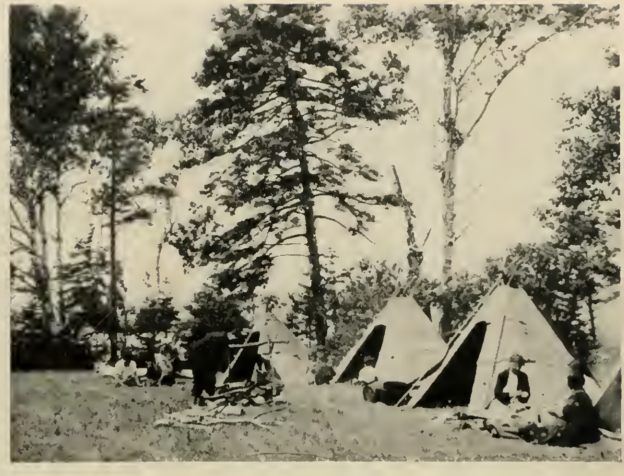


(Left) WHEN DRY THE BLUBBER was cut into one-inch cubes, and again after forty years the spruce-laden breezes were filled with the hot smell of porpoise blubber being boiled. Matthew controlled the fire carefully, for if the oil boiled over, the whole pot-full would catch fire and be ruined

(Below) HOW IT USE TO BE DONE: the old hunter demonstrating how the oil was stored in rum kegs for transportation to the market



THIS PORPOISE yielded about a gallon and a half of oil, deep amber in color and perfectly clear. The lower jaw yielded oil used formerly by watchmakers



A MICMAC SUMMER VILLAGE much as it use to be when the porpoise trade was at its peak. The Micmacs migrated to the coast every summer in birch bark canoes carrying even their birch bark wigwams, rolled up. At the coast porpoise hunting occupied them for two and a half months

WHILE THE MEN were at sea the children played simple games. The games are still played today, but in a few years the game of porpoise hunting will undoubtedly be completely forgotten

BASKET WEAVING: a pastime and profession of Micmac women. Baskets are still made for sale and today the Micmac men have taken up occupations almost as sedentary could hear at first-hand what I was hearing. The desire to see as well as hear came to me and I decided to make a moving picture of the process.

Among the Bear River Indians, Matthew Pictou was the only one of the former porpoise hunters sufficiently young and able-bodied to put down the bay again in a canoe. Matthew was seventy-four. Some of the younger Indians declared that they would be willing to go as Matthew's partner, and do what he told them. Others said that there was not enough money in Nova Scotia to get them out on the ocean in such small craft.

Matthew not only combined knowledge and physical fitness, but was animated by a rare and friendly spirit.

"There ain't a man," he said, pointing with the stem of his pipe, "on this coast from Briar Island to Cape Split, that can say one word agin' me. I'm friends with everybody." Which was true, if not modest.

Film planned

With his wife, Mary, and another Indian family, the Lewises, we planned the film. Matthew made the spear and helped Joseph Lewis build four bark wigwams and a village fireplace. I secured an old porpoise pot for the boiling and a seaworthy bark canoe. This last was as rare as a seaworthy porpoise hunter. The boat which I finally got was a little small for the job, only fourteen feet long, but otherwise made in the right style. Malti Pictou built it thirty years ago.

Matthew took Joseph Lewis as his bow partner, and while the Indians hunted, I followed in a motor boat, observed and photographed.

Some of our days were made of brilliant, blue mid-summer, speckled with foam and white seagulls. Matthew felt the spirit of the wind and the chasing of sea monsters. He slapped the sides of the canoe and shouted aloud to me on the motor boat, "Gawd, boy, this ain't the first time I been out on this old bay."

One calm evening, when the boat lay with its engine silent, and the Indians were hunting not far away, I could hear, from time to time, the rush of expired air from the porpoise blowholes without seeing the animals at all. That was a lonely sound on the water, a disembodied sigh, distant from the land. I had a fearful feeling that the ocean had opened for a moment and whispered. Once or twice a porpoise leaped right out of the water and Matthew said that when they did that they were going down for a long time and there was no use paying any attention to them. We wanted the slowly rolling kind that kept coming up. One could guess the point of next appearance and get near it before the animal arose. The porpoises seemed intent on their own business of pursuing fish and neither avoided nor approached the canoe. The noise of a shot did not appear to frighten them. There were times when they would lie idly on the surface, the dorsal fin in the air. Once I mistook this for a piece of driftwood, black, wet, and reflecting the sun, until I approached and it slipped beneath the surface.

The first porpoise that Joe shot was about twenty feet from the bow of the canoe and it sank before he could spear it. Looking down, he said that he could see it drop, slithering from side to side like a flat stone. There was a little patch of oil left on the surface. After every shot Matthew would look for this to see whether or not the porpoise had been hit. He advised Joe to shoot while the animal was still on the up-turn of its roll, not after it had started down again. The place to strike, he said, was just below the dorsal fin. Hit properly, the porpoise lifts its snout and remains thrashing at the surface. If hit farther forward, it dies and sinks at once. Hit elsewhere, it escapes. I suspect that the shot below the fin breaks the animal's back.

A porpoise captured

The porpoise we got was taken on July thirteenth, in the Digby Basin, about a mile from Port Wade. It was a female Harbor Porpoise (*Phocaena communis*) with milk in its mammae. A small porpoise was seen playing near it. When the animal had ceased struggling, Joe passed it back to Matthew, who disengaged it from the spear. The old man, with his pipe between his teeth, pulled the porpoise aboard so gracefully and easily that the canoe gunwales scarcely moved two inches. He put the index and middle fingers of his left hand in the blowhole, grasped the left flipper in his right hand, and pulled the porpoise on its belly over the gunwales. The trick was in continually shifting his weight to balance the changing position of the porpoise. Once on the bottom the animal was pushed up nose first under the thwarts.

When we came ashore Matthew went to work on the porpoise. He cut off the dorsal fin and then split the blubber from nose to tail, cutting right down to the muscle; the tail was cut away from the spine, but left attached to the blubber ventrally. The blubber and the skin together were peeled away from the spine on both sides, until detached in one complete sheet with the flippers, the lower jaw, and the flukes connected. The blubber on our porpoise was only about an inch thick—a sign that the animal was in poor condition. The skin, Matthew said, was not good for leather in this species. Only the large sea porpoises have hides that are sufficiently tough.

Matthew spread the blubber on the beach and turned his attention to the rest of the carcass. He pulled it over on its back, split it open ventrally and cleaned out the entrails. The desirable meat was removed and consisted of ribs, kidneys, and the long muscles of the back. The meat and the blubber were carried to the camp and while the meat was placed in brine to soak, the blubber was hung on a horizontal pole to dry. Matthew said that in fine weather twenty-four hours were sufficient to remove the moisture, but at other times it took several days. When it rained the blubber was folded double, with the skin turned outward to make it waterproof. When the blubber was dry enough to suit Matthew, he sat down beside the large black porpoise pot and put a board across the top of it. On this board he cut the blubber into one-inch cubes and scraped them off the edge into the pot below. He worked with great speed and within three-quarters of an hour the whole sheet of blubber was in the pot in small pieces.

The pot was hung over a fire and boiled for an hour and a half. Matthew controlled the fire carefully, because he said that if the oil boiled over the whole potful would catch fire and be ruined. The oil boiled up almost to the brim of the pot, foaming and white like cream. A sickly hot smell mingled with the salt and spruce fragrance on the breeze. The Indians kept a small frying pan in readiness to ladle out the oil when it rose too high. The boiling finished, the oil was allowed to cool and then poured into a rum keg. The total quantity equaled about a gallon and a half, was deep amber in color and perfectly clear.

Palatable meat

From the fat on the posterior part of the lower jaw, a more refined oil could be extracted which in the old days was boiled separately and sold to watchmakers.

After the meat had stood in brine for a day, we boiled part and fried the rest. The flavor was very palatable, a little like liver and not in the least fishy. The tail was, however, considered the choicest cut. It was treated by holding it in the fire until the skin crinkled and could be scraped off, after which the flesh was roasted.

When the oil had cooled, our work came to an abrupt and unnatural end. It seemed wrong that there should be nothing more to do—no place to take it, no place to sell it.

This full stop caused me to sit back and survey the information I had acquired. As I reflected, the details grouped themselves to form a whole picture that was full of meaning. I thought that I saw the Micmacs in terms of centuries and their problems as a race.

At the time of the American Revolution, the white population of Nova Scotia was very small and the Indians hunted comfortably in the forest. After the Revolution, great numbers of the Tory colonists fled from the new-born States to Nova Scotia. By the early part of the nineteenth century they had increased the population to such an extent that the hunting ranges of the Indians began to grow small in size and poor in game. The Indians became pressed for food. The agricultural people, who could live numerously in a small area, were crushing the hunting people, who needed miles of valleys, ridges and woods full of animals. This was, of course, merely another phase of the frontier pressure on the Indian which was occurring and had occurred all over North America. In most cases the Indian could not adjust himself and died, as he had been born, a hunter. Farming, trading, or laboring were not for him, and when he could not subsist by his own hands in the woods, he became bewildered, idle, degenerated.

Inability to accept agriculture was not the only cause of his disappearance. Intermarriage with whites, tuberculosis, and alcohol, played their parts, but the cultural conflict is, I suspect, the most important factor.

When this crisis was reached in Nova Scotia, the Micmac found a wonderful solution that enabled him to possess his own soul and live pleasantly near the European settlers. When the woods became pastures, when the salmon rivers spun saws, the Bay of Fundy Indians went out on the sea where there were no fences, axes or plows. They hunted porpoises and made oil which they sold to the white man to use in mowers, wagons, mills, and the unwanted hunting gypsy found a valued place for himself, profiting by the very machinery that had driven him and his game from the woods.

A fatal accident

One evening a little before I left Nova Scotia, I went with Matthew down to the salt marshes to learn how to gather and clean sweet grass. When we had collected a bundle and were sitting on the edge of a stubble field preparing it, I asked Matthew about the end of the porpoise hunting. "Was it sudden?"

"Yes, pretty sudden, 'though some hung on for quite a while."

(Continued on page 458)

WILL SHARKS ATTACK HUMAN BEINGS?—*The question answered by an account of an authentic attack at Palm Beach, Florida, in 1931, on a girl bather who recovered to tell the tale*

By E. W. GUDGER
Associate Curator of Fishes
American Museum of Natural History

THE question whether a marauding shark will attack a human being has long been a matter of much and sometimes acrimonious controversy. While most people believe that they will, there are those (and notably Dr. William Beebe) who take the negative side and offer to prove their faith by boldly going into waters where sharks abound. These upholders of the negative aver that the alleged attacks are due to the fierce and ravenous barracuda so common in our southern waters, and that no authentic case of shark bite has ever been recorded for these same waters. Having studied the barracuda and its habits, I too, believe that it is responsible for most alleged cases of shark bite.

However, I will now cite in detail an authentic occurrence of a shark attack at Palm Beach, Florida, and further on shall quote the records of other established attacks on human beings on our coasts. This particular account is based on the testimony of Mr. Sam Barrows, lifeguard on duty at the time, and of Miss Gertrude Holaday, the victim; and also on the records* of the Hospital of the Good Samaritan at West Palm Beach, where treatment was given.

On September 21, 1931, a calm clear day, Miss Gertrude Holaday was swimming off the municipal beach about 200 feet out when she was attacked by a huge fish. She had turned to swim to the shore when she looked down and saw it quite close to her. When she tried to swim away, she noticed that the water was red with blood. Due to excitement and to shock, and perhaps to paralysis of the sensory nerves in the region of the cuts, she had not felt the bites on thigh and calf. This lack of sensation has I believe been reported before in similar cases. At any rate when the victim, swimming toward the shore, saw the fish and the bloody water, she screamed for help and tried to push away the great fish, whose skin she said felt like sandpaper. She fortunately did not lose consciousness but continued to call for help and to splash as much as she could to keep the fish off.

The victim's screams were heard on shore and Mr. Sam Barrows, lifeguard on duty, seized a can buoy (with a stout line held by spectators on the beach) and swam out to her. As he approached the girl, he could see that the attacker was a hammerhead shark about 8 feet long. As the girl swam toward him, she left a wake of bloody water with the shark following behind. When the lifeguard approached threshing vigorously, the shark drew off a bit. Barrows then caught the girl with his left hand and had her hold on to him with her right hand and on to the buoy with her left. With his right hand and leg he swam, threshing vigorously to keep the shark off. And the crowd on land pulling on the line quickly drew the pair close inshore.

The shark, crazed by the blood in the water, followed them so closely in to shallow water that it was clearly seen by the spectators.

I closely questioned Mr. Barrows, suggesting that possibly this attack was made by the more dangerous barracuda. He knows the barracuda well (as all coast-dwelling Floridians do), and he knows the clean-cut bite of the double-edged knife-like teeth of this fish. Furthermore he saw the fish distinctly and the girl said its skin felt like sandpaper. Barrows knows two men who have been bitten by sharks in the Palm Beach region and has seen the scars, and he knows of a third man who was attacked by a barracuda. The lifeguard, who gave first aid in this latter case, was his stepson. There seems no room to doubt that Mr. Barrows knows how shark bite scars differ from those made by the barracuda, and that the attack under consideration was made by a shark.

When they got to shore, Barrows gave the girl a stimulant, put a tourniquet around the upper part of the injured leg and washed the blood away with salt water. In the meantime a call had been put in for an ambulance and the wounded girl was quickly taken to the Good Samaritan Hospital in West Palm Beach. There it was found that she was in extreme shock due to fright, loss of blood, exhaustion and cold. She was first treated for shock with saline, with morphine sulfate (given hypodermically), and with external heat.

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*These records were kindly supplied by Miss Robena Davies, statistician of the hospital, and by Miss Kathryn Gutwald, superintendent of nurses, who helped in the operating room when the surgeon was caring for Miss Holaday.

She soon reacted, and the leg and the wounds were cleaned of blood and sand with soap and water and flooded with iodine solution. There were several jagged lacerations of right thigh and calf. The largest, 10 inches long, was on the thigh. Here the muscles were torn from the bone but fortunately the large deep-seated blood vessels escaped injury. The cut on the right calf was about 5 inches long. In addition there were other smaller cuts on the right leg, and on the left leg were found abrasions and lacerations made presumably by the horny shagreen of the shark's skin as he threshed about the girl when she was striving to get away.

A "debridement" was done on the wounds, of which there were a number of small ones in addition to the two large ones noted. The blood vessels were ligated, the frayed out muscles were carefully trimmed and the ends were coapted or joined with absorbable catgut, drains were inserted and the outer edges of the skin wounds were sutured—more than 200 stitches being required for all. For several days drainage was profuse and the wounds were irrigated with hot boric acid. Heat from an electric light cabinet was found beneficial. The patient's temperature ran to 101° and 102° for several days and then dropped to normal. When the inflammation had subsided, general massage, external heat and hot compresses were used. For the first three weeks, there was almost complete loss of sensation in the right foot and lower leg but much severe pain. However, the patient's recovery was in the main uneventful and on November 11 she was able to hobble out of the hospital on crutches.

The patient was admitted to the hospital September 21 and was discharged on November 11—seven weeks later. On her return home, she was in bed for about a month while she gained more strength, and when she got out she was on crutches for about two months longer. When able to walk alone, she found the leg stiff and she had a slight limp. After a year, however, she had completely recovered, and now is as active as before the hurt. She swims, walks and runs like any normal girl. Unfortunately no photograph was made of the wounds, and when I asked for one to be made of the scars, Miss Holaday wrote that these were so insignificant that they hardly show at all.

This excellent recovery is surely due to youth and a sound constitution, plus the splendid job done by the operating surgeon and the hospital attendants.

Mr. Barrows, for this remarkable rescue, was presented with a gold medal by the town of Palm Beach. But of the whole matter he writes me thus: "Please do not for a minute imagine that I consider myself a hero (and *please* do not write me down as such). I was just one badly scared lifeguard. But I had to go to the girl's rescue—that was a part of my job."

Some of my readers have been wondering why this attack of September, 1931, has gone unrecorded until June, 1937. The explanation is that until September, 1936, I had never heard of it. Indeed, I came to know of it in the following unusual and interesting way.

On July 25, 1936, a boy, in bathing near Woods Hole, Mass., was attacked by a shark and so terribly hurt that he died from shock and loss of blood. This case has been thoroughly investigated and a formal report will be prepared and published presently.

Incited by this well attested attack, I prepared and published* a short general paper on the subject. In this paper brief reference was made to a number of attacks reported from the Hooghly River at Calcutta, and especially to the large number of fatalities which have been recorded on the southeastern coast of Australia, and finally to the very few which have been authenticated on our own Atlantic coast.

This article was abstracted by the great news agencies and widely published from Maine to California and from Minnesota to Florida. One of these abridgements was read by Mr. Barrows, who kindly wrote me about his experience. This led to much correspondence with him and the victim, and with the hospital authorities—to all of whom I have made grateful acknowledgment elsewhere.

At the time I wrote the general article referred to, it was widely believed that this was the first attested account on record for our waters. Not so, however, for Mr. E. Milby Burton, Director of the Charleston (S. C.) Museum had already published an account† of shark attacks in the waters near that city. To this article with its definite data and photographs, the interested reader is referred.

Then to the question asked in the heading to this article, the answer must be, that while shark attacks in our waters are rare, still, here and elsewhere—

Sharks Sometimes Do Attack Human Beings.

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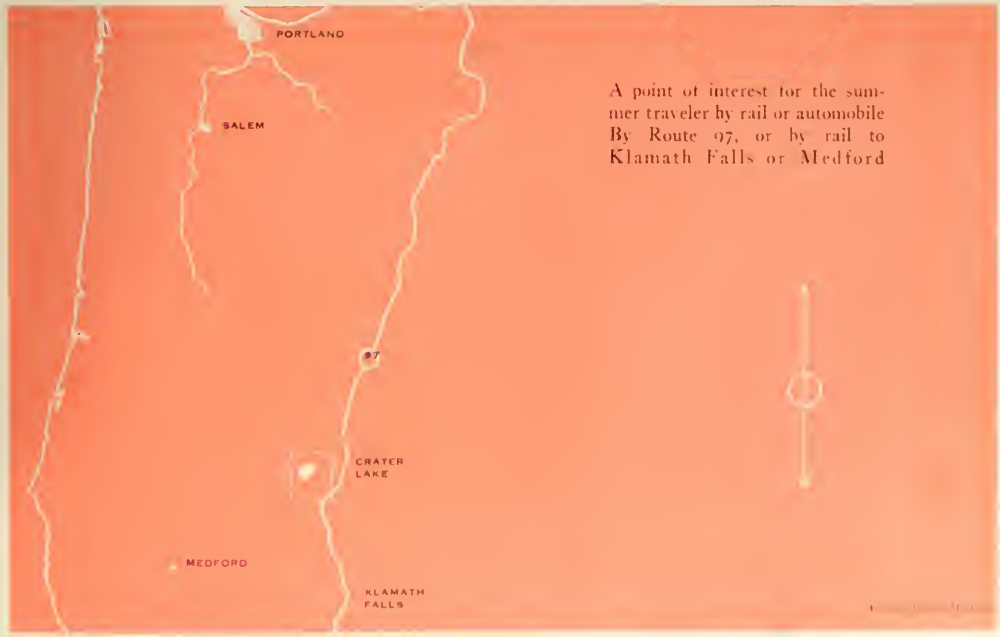
*Open Ocean and Coastal Sharks: Do They Attack Men? The Collecting Net, Woods Hole, 1936, vol. 11, 3 p.

†Shark Attacks along the South Carolina Coast. *Scientific Monthly,* 1935, vol. 40, pp. 279-283, 2 figs.

THE FLOWERS OF CRATER LAKE

By F. LYLE WYND


PORTLAND
SALEM
97
CRATER LAKE
MEDFORD
KLAMATH FALLS

A point of interest for the summer traveler by rail or automobile By Route 97, or by rail to Klamath Falls or Medford

THE FLORAL WEALTH OF CRATER LAKE—*Flowers of unsurpassed beauty and variety form the setting of this jewel-like lake in the crater of an extinct volcano*

By F. LYLE WYND

About fifty years ago a country school boy sat in the shade of a wild crab-apple tree munching his lunch of sandwiches. He was reading the newspaper in which they had been wrapped. It was no ordinary newspaper, for it contained a short paragraph about a mysterious and unbelievable lake somewhere in the remote territory of Oregon. This description, brief as it was, so fired the imagination of this mid-western youth that, then and there, he made the mighty resolve that he would most certainly see this fabulous phenomenon of nature. Such a resolve had to be "mighty," for in those days a journey to Oregon was not a thing to be taken lightly.

Journey's end

It is a long story and a true romance of western adventure how that school boy did actually go to Oregon looking for Crater Lake, and how he spent eight years restlessly wandering through the great Northwest before he found it. And having found it, breathlessly he gazed into its depths and again made a mighty resolve—this time to preserve this masterpiece of nature's creations as a National Park for the enjoyment of the American people for all time. The story of how he did this is the true Odyssey of William Gladstone Steel.

Many things have happened since this mid-western country boy came to Oregon. The goal of the tortuous path that he followed for eight years is now easily attainable in a very few days, for today Crater Lake National Park may be reached by an unbroken paved highway from the most remote corners of the nation.

Every summer thousands and thousands of Americans sally forth in their family cars to see for themselves the wealth of natural beauty that our government has preserved there for their enjoyment. The traveler usually approaches Crater Lake by way of Medford. The highway winds through the Cascade Mountains and their magnificent forests for eighty miles, then a last three miles of skilfully engineered highway coils up the base of the ancient Mt. Mazama, and there it is—suddenly without warning—before our eyes, a lake that will always be unbelievable. It is set in the base of an ancient and collapsed volcano, surrounded by cliffs from 500 to 2000 feet high. It is 2000 feet deep and five miles across, and is as blue as blue can ever be.

But there are many things in Crater Lake National Park. The most conspicuous thing, of course, is the lake itself, and travelers too frequently limit their definition of "scenery" to include only the most obvious geological features. But a constantly increasing proportion of the tourists in the National Parks have discovered that "scenery" includes everything from Yosemite's Half Dome to the tiny *Viola blanda,* which is a shrinking violet if ever there was one.

Hidden beauty

It is just such things as these, the myriads of violets, the hillsides of blue lupines, the mossy logs in the deep forests covered with orchids, that we must see if we are to enjoy all of the wealth that awaits us at Crater Lake. The National Park Service has established a staff of naturalists and guides to aid us to see more completely these less conspicuous but equally fascinating bits of scenery.

The wild flowers that bloom so luxuriously in the National Parks certainly constitute one of the aspects of nature which tourists may ignore only to their own loss. It is true that in some of the Parks, Mount Rainier for example, it would be as easy to overlook the mountain itself as the flowers that blanket the countryside. The flowers are there in countless thousands in areas that are visible even to the most casual traveler; and tourists have come to recognize the flowers of Mount Rainier as one of the scenic attributes of the region.

But at Crater Lake—how different and unjust is the often repeated remark, "When you have seen the Lake, you have seen everything," for Crater

Lake National Park has a flora that is as rich in species and in individuals, and as magnificently beautiful as any area of the same size in the entire West. But nature and man seem to have conspired to hide this beauty from the traveler. The excessively dry soil about the Rim supports a comparatively small number of species, and the highways that approach the Lake, by some concatenation of fate and engineering, have managed to avoid places of floristic beauty.

If we look into the scientific literature of Crater Lake National Park, we find that 426 or more species have been discovered within its boundaries. These are distributed in 202 genera and 53 families! The daisy family (Compositae) is the largest, and the next in size is the Graminicae, or grasses, although we have heard many times that Crater Lake National Park has almost no grasses. The lily family is represented by fourteen species, and there are eight species of native orchids.

Where to look

But where may they all be found?—for certainly they do not thrust themselves before the traveler as do the flowers at Mount Rainier. An adventurous person may find them with but little difficulty—in the swamp just below Park Headquarters, on the sunny hillside south of the camping ground on the Rim, in the canyon just back of the Lodge, at the foot of the talus slopes of Castle Crest, along the trail from the Lodge to the Boat Landing, on Wizard Island, and even on the Phantom Ship itself. The writer has found twenty-five species of plants in a single afternoon, blooming on the almost perpendicular cliffs of the Phantom Ship.

The traveler who has limited time will find a choice spot already picked out for him. At Park Headquarters there are several glacial moraines between the highway and the base of Castle Crest. They are comparatively small and are seldom noticed except by students of geology, but in the little valley, scarcely 100 yards wide and 500 yards long, that lies hidden behind them, there is the largest number of native species of flowers that one may ever hope to find in a small area. All this luxuriance is due to several springs which keep this miniature valley supplied with life-giving moisture the whole season through. A trail has been so constructed as to pass near the greatest possible number of plant species. Along this trail, which cannot be more than one-half mile long, there are over 200 species of plants—almost one-half of all that occur in the Park. These species are all growing just as nature planted them, for there has never been artificial planting in this floral paradise.

Crater Lake National Park has been subjected to some very severe environmental conditions during past geological time. During the Great Ice Age, ice covered the slopes of old Mount Mazama and most of the surrounding country. And then the mountain collapsed, the Ice Age passed away, and the flowers once more crept up from the lower altitudes, a little further each season. These were strenuous times in the lives of the flowers. Some species perished entirely while others became modified in their structure and mode of life. Perhaps the struggle for existence under these trying circumstances favored the modification of existing species, perhaps changes occurred in floral structure for no reason at all or for reasons that we could not possibly understand, but the fact remains that at the present day there are seventeen species of plants growing in the vicinity of Crater Lake that grow at no other place in the world.

We do not know when or how or why these strange plants came to be in this locality. But here they are: the tiny prostrate Adder's Tongue (*Botrychium pumicola* Cov.) along the highest parts of the cliffs, Applegate's Indian Paint Brush (*Castilleia Applegatei* Fernald) on the slopes of Mount Scott, the Mazama Collomia (*Collomia mazama* Cov.) in the deep woods, the Creeping Currant (*Ribes erythrocarpum* Cov. & Leib.) that literally covers acres and acres of the forest floor, the Dissected Buttercup (*Ranunculus occidentalis* var. *dissectus* Hend.) along Pole Bridge Creek, and all the others of this strange company which the Park Naturalists will point out to the traveler.

Ash-like soil

With the collapse of old Mount Mazama, the glacial valleys that flutted her sides no longer had a source of water. In truth, the upper elevations are to this day saturated with the melting of each season's snow, but hardly does the bare earth appear in the spring until the porous volcanic soil becomes as dry as baked ashes.

Many species of plants have learned to live even under these discouraging conditions. The ferns send roots far down into the earth searching for water, the Bleeding Heart, the Lupine and the Phlox have also learned this trick. Then there are others such as the Spring Beauty (*Claytonia lanceolata*) and the single flowered Bleeding Heart (*Dicentra uniflora*) which make no such effort to find and extract water from the soil, for they have solved the problem in their own way. They push up from the earth at the earliest possible moment—even through the snow itself—and burst forth into bloom while the soil is yet wet from the snow. Thus all in a brief

Photos by Sawyers

AMONG CRATER LAKE'S 426 SPECIES one of the most conspicuous flowers is the brilliant blue Fleabane *(Erigeron salsuginosus)*

AS SOON AS THE SNOW IS GONE, the pumice slopes become carpeted with Phlox. Later, in soil like baked ashes this plant survives by virtue of its deep roots

WIZARD ISLAND, an unbelievably dry cone of volcanic rocks on which 36 species of plants find their precarious living. During the Great Ice Age, ice covered much of the country surrounding Crater Lake. The struggle for existence then and later under trying climatic conditions may be one cause of the great variety of the flora. Seventeen species of plants growing near Crater Lake are found nowhere else in the world

Southern Pacific Photo

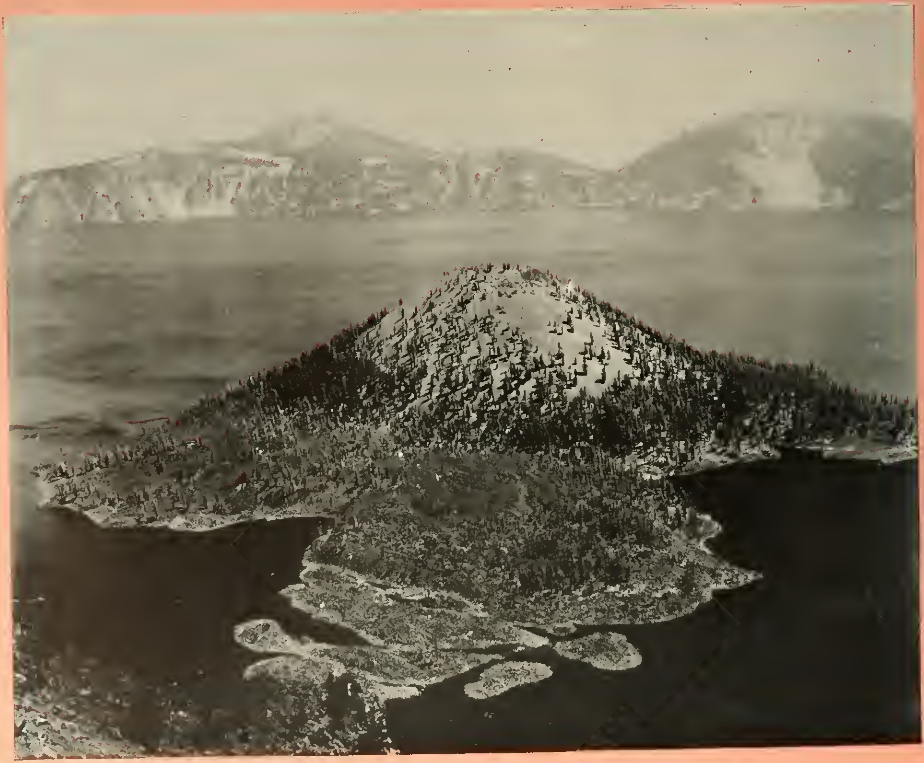


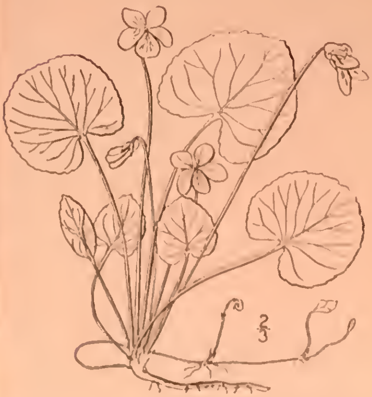
Photo by Sawyers

THE LIVE-FOR-EVER *(Sedum spathuli folium)* grows in moist places along the base of Castle Crest. Relatives of this plant are frequently cultivated in flower pots and window boxes

The largest number of native species of flowers that one may ever hope to find in so small an area grow in a 500-yard valley near the base of Castle Crest

Photo by Sawyers

AT THE HIGHEST ELEVATIONS the gnarled White Bark Pine replaces the dense forests of Mountain Hemlock. This tree, clinging precariously to the edge of the crater, is about 600 years old but only 10 feet high



(From Illustrated Flora by Britton and Brown)

(Above) A SHRINKING VIOLET if ever there was one: *Viola blanda*

THE DELICATE BLUE FLOWERS of the Clustered Penstemon *(Penstemon micranthus)* bloom along the dry ridges in late summer

CLUMPS OF THE FEATHERY BLUE FLOWERS of *Eupatorium occidentale* may be found in the canyon back of the Lodge

Photos by Sawyers

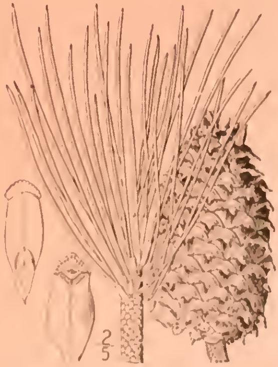
(Below) SPLASHES OF COLOR appear on the rocks in late July where the blue flowers of Davidson's Penstemon burst forth in masses

(Right) CRATER LAKE: a diadem set in a colorful panorama of volcanic rock, evergreen trees and rich floral growth *(Southern Pacific Photo)*

(Above) GROWING FROM CRAGS IN PERPENDICULAR CLIFFS, the deep pink flowers of Cliff Penstemon *(Penstemon rupicola)* attract the attention along the trail from the Lodge to the Boat Landing

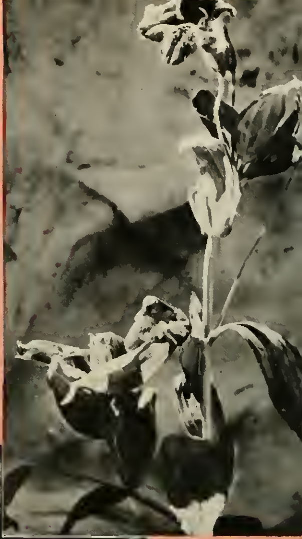
Photos by Sawyers

(Above) WHY ARE THE WILD BLEEDING HEARTS *(Dicentra formosa)* at Crater Lake a deeper red than the same species growing elsewhere? This is one of many riddles which puzzle the beholder of the floral wonders of this region



YELLOW PINE. Forests of this tree *(Pinus ponderosa)* characterize the Transition Zone *(From Illustrated Flora by Britton and Brown)*

(Right) DENSE GROWTHS of the Pink Monkey Flowers *(Mimulus Lewisii)* grow along the stream sides, which display a floral growth that is almost tropical in its luxuriance. This plant bears many deep red flowers about an inch long and often grows two feet high



Photos by Sawyers

(Above) THE LAMB'S TONGUE, or Dog-Toothed Violet, pushes up through the snow early in July. This early growth is made possible by the store of food accumulated in the bulb during the previous season

(Left) ONE OF THE FOUR SPECIES of Indian Paint Brushes growing at Crater Lake. Only expert botanists can distinguish these species from each other. But even the casual motorist can observe many interesting things about the distribution and association of plants

moment their life cycle is completed and they fall back to the earth exhausted, but with twelve long months in which to gather strength for their next burst into life.

Water! water! how the wild flowers depend on it! In the later part of August, the pumice slopes are already showing great areas dry and barren, exhausted of their scant supply of moisture, while along the few tiny streams that survive through the summer there is still a congested, brilliantly flowering vegetation that is almost tropical in its luxuriance. Among those plants that have learned to hug the stream sides, one finds the most beautiful flowers of the Park. There are three species of Monkey Flower. The Pink Monkey Flower (*Mimulus Lewisii*) often grows two feet high and bears many deep red flowers about one inch long; another species is almost of equal size (*Mimulus gutattus*), but bearing yellow flowers; while a third species (*Mimulus primuloides*) is the dwarf of its kind, growing only two inches or less high. The Klamath Broad-leafed Lupine (*Lupinus latifolius* var. *ligulatus*), the Butterfly Tongue (*Pedicularis groenlandica*) and the dense thickets of Pink Spiraea (*Spiraea densiflora*) and willows (*Salix orestera*) are conspicuous members of the flora that crowds close to the stream sides.

Orchids

In the shade of the deepest forests one may find quantities of inconspicuous but inconceivably delicate orchids, tiny huckleberry bushes bearing minute pink berries, several species of Wintergreen and a large number of other equally interesting species. But for that matter all plants are interesting and they occur wherever we look.

Those nature lovers who have learned to observe and to relate their observations to each other, will notice three main floristic zones at Crater Lake, each characterized by a type of forest. It is remarkable that almost the entire vegetation differs as the forest type differs.

At Crater Lake, the Transition Zone is characterized by the forest of Yellow Pine (*Pinus ponderosa*). This occurs only at altitudes less than 5500 feet. A fine example of the flora of this zone may be seen near the south entrance ranger station. This is the zone of underbrush so dense that one frequently finds it almost impossible to force a way through.

The Canadian Zone includes the altitudinal belt between 5500 and 6250 feet. The typical tree is the Lodge Pole Pine (*Pinus contorta* var. *Murrayana*). Here, there is no underbrush, except scattered clumps of Wild Currants (*Ribes*) and a few other shrubs.

The Hudsonian Zone extends from 6250 feet to the highest elevation in the Park. This is the region of dense forests of Mountain Hemlock (*Tsuga Mertensiana*). At the highest elevation, the Mountain Hemlock is replaced by the White Bark Pine (*Pinus albicaulis*). Here, there are almost no shrubs at all, and the earth is covered by Rushes (*Luzula*) and a few grasses. All the area immediately surrounding the Rim is included in this zone.

The highway from Anna Spring Ranger Station to Park Headquarters follows almost exactly the boundary between the Canadian and Hudsonian Zones. On one side there is the Lodge Pole Pine forest with its typical floral associates and on the other is the Mountain Hemlock with its different group of species. Even the most casual observations of the passing motorist are sufficient to detect that plants occur in clearly marked areas and associations and are not all mixed up over the countryside.

Nature's inscrutable ways

When we observe the flora of our National Parks, our contemplation of beauty soon gives way to a thoughtful wonderment.

Why are the Bleeding Hearts growing near Crater Lake a deeper red than the same species growing in other localities?

Why do the Firs and the Hemlocks fairly break with their burden of fertile cones one season, but be barren often for five or six years at a time?

Why are there so many plants that grow commonly about Crater Lake but grow no place else in the world?

And finally, what are those mysterious factors that cause the plants to associate themselves in such clearly defined groups?

These are but a few of the questions that will puzzle the true lover of the outdoors, and long after he has returned from his holiday trip he will still ponder the inscrutable ways of Nature.

THE DRAGON OF THE LIAS EPSILON—*The story of a submarine death valley of 130 million years ago where the skeletons of multitudes of extinct sea dragons accumulated probably owing to the action of poison gas*

By WILLY LEY

In my collection of pictures relating to natural history there is one of which I am frequently reminded. Not because it is a particularly good one—quite the contrary. Its interest and significance lie in the lesson it teaches of the changes that take place in scientific ideas, and of the danger of using too much imagination.

The picture was the frontispiece of a once famous book and purports to represent the prehistoric *Ichthyosaurus. Ichthys* (Greek) means fish, and *sauros* lizard; so *Ichthyosaurus* means "fish-lizard." Since the time the picture was drawn about a century ago, the name of the animal has been changed. *Ichthyosaurus* is now used for a whole group of animals, while the type that is most abundant—or *was*, 130 million years ago—has received the name *Stenopterygius*. As an engineer friend of mine remarked: "When people finally manage to pronounce the names invented by the naturalists, the name is soon changed into one that is still harder to remember and more difficult to pronounce." Of course, there are other reasons for changing names, but it is of no use to argue about those things with engineers.

Unreal

There is no doubt that the old engraving looks impressive. It even has artistic qualities, but the general effect is somewhat humorous. Ichthyosaurs and plesiosaurs are battling in raging black water under the pale light of a full moon half hidden behind black clouds. The carcass of a dead ichthyosaur is lying on the shore, prey to flying reptiles of a type never found, neither fossil nor alive.

The unhappy fish-lizard that is engaged in a fight with two ferocious looking but wrongly drawn plesiosaurs appears to have the bulk of a medium-sized battleship. Its eyes are staring vertically upwards in despair, its mouth is about as wide as that of a crocodile, its fins are a cross between the feet of a crocodile and those of a mythical sea horse of ancient Greek mythology.

There is only one mistake the artist forgot to make, the ichthyosaur neglects to spout two fountains of water as is customary for mythical sea monsters.

Truth out of fiction

Since then we have learned how the ichthyosaur actually looked.

It is, of course, very difficult to tell how an extinct animal looked. The remains discovered are bones, generally crushed, disordered and partly disintegrated. There is usually no trace of the soft parts of the body, neither fur nor scales, nor the slightest hint of the original coloration. Sometimes the skull is missing while the rest of the skeleton is abundantly represented, and in such cases no one can safely predict the size and shape of the head. Predictions of this sort have been made several times and when the skull was actually found there was an embarrassing surprise. Other prehistoric animals are known only from their skulls and jaw bones. And there is one famous case where the only traces we have of the animal are its tracks, which curiously resemble the prints of hands. The rocks where these tracks are found in considerable abundance did not preserve a single bone of this creature, appropriately named *Chirotherium* (hand beast), or of any other animal.

In another case of mysterious footprints, a lucky solution was discovered. For years it was impossible to identify the tracks that a huge prehistoric animal had left on what is now the coast of England. Not a single fossil bone was unearthed that could be connected with the creature that had walked there. Then suddenly news came from Belgium that not less than twenty-three complete skeletons of a large biped saurian (iguanodon) had been discovered near Bernissart, imbedded in stone and occupying the original postures in which death had caught the animals when they drowned in a prehistoric swamp. Iguanodon's hind feet fitted the English fossil footprints perfectly.

The story of the ichthyosaur is somewhat similar to the story of the iguanodon, being only more complicated because the lucky event did not happen so soon. Parts of the spine of an ichthyosaur were found and described as early as 1708 by the German Johann Jakob Baier, who mistook them for bones of fishes. In 1814 the first fairly complete skeletons were found in England; and in 1824 additional material came to light in Germany. The first "rough draft" of the reconstruction was made, and the ichthyosaur was seen to have a fish-like body, between six and ten feet long from the point of the long snout to the tip of the tail. It had four strong paddles and a powerful tail. The head was equipped with long dolphin-like jaws which housed nearly two hundred needle-sharp teeth.

Fish or reptile?

For a while it was uncertain whether this creature of bygone ages should be regarded as a fish or as a reptile. Then Georges Cuvier in France and Richard Owen in England decided, correctly, in favor of a reptilian relationship.

A few especially well-preserved specimens gave additional hints. They disclosed that the diet of the animal consisted mainly of octopi of various now extinct kinds, ammonites and belemnites. Another discovery which caused a long and lively controversy was a large specimen inside of which twelve or thirteen little ichthyosauri could be seen. The obvious conclusion was that ichthyosaurs did not lay eggs as most reptiles do, but produced live young. There are still living reptiles that do the same. A few authorities in paleontology, however, interpreted the evidence in another way. Here was remarkable proof, they said, that already in the Jurassic period reptiles occasionally ate their own young. The reason for this interpretation was the relative position of the young in the body of the mother. Some of the young even seemed to lie in association with other food material.

After a lengthy controversy, in the course of which a few specimens were photographed with X-rays, it was finally agreed that *both* explanations were right.

Meanwhile it had been found that the majority of the better specimens showed a feature which was most surprising and not very easy to explain. About one and a half feet from the tip of the tail the spine was bent or broken in a most peculiar way. It was not broken so completely as to appear to have dangled; it was only bent to an angle of 40 or 45 degrees. When the first three or four specimens exhibiting this feature were found, at long intervals, the spine was neatly straightened out. It was believed that the pressure in the rocks had caused the deformation.

Professor Richard Owen in London was not quite so certain of this explanation. He reasoned that the ichthyosaur may have had a heavy tail, possibly like the horizontal fin of a whale, whose weight would cause the spine to bend or break in a certain spot when the carcass of the dead animal floated on the surface of the water.

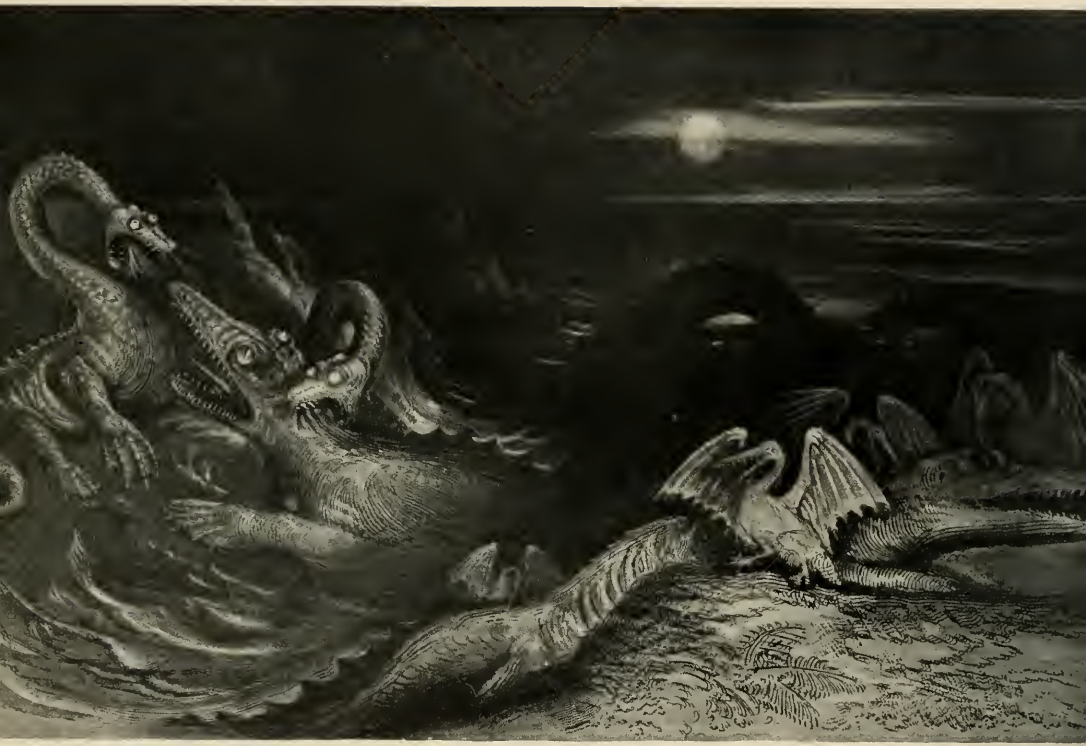
The theory was ingenious but wrong. It needed a few more discoveries of a novel and unexpected kind to solve the mysteries about the actual shape of this ancient sea dragon. These novel discoveries came from a place which soon became famous as the most important tomb of ichthyosaurians. Though fossil fish-lizards have been found in almost every country of the northern hemisphere most of the specimens exhibited in the museums and the best preserved specimens come from Holzmaden in Württembergia, Germany.

They are digging up fossils at Holzmaden at the rate of about one a day. Most of them (about 150-200 a year) are ichthyosaurians. Near Holzmaden lives Dr. Bernhard Hauff, a scientist who has specialized in the fossils of the place and who is famous for the marvelous technique he has developed in preserving the specimens. It is almost incredible what Doctor Hauff does to the battered and broken fossils. He knows exactly which one of the many specimens discovered deserves preservation.

Scientist and craftsman

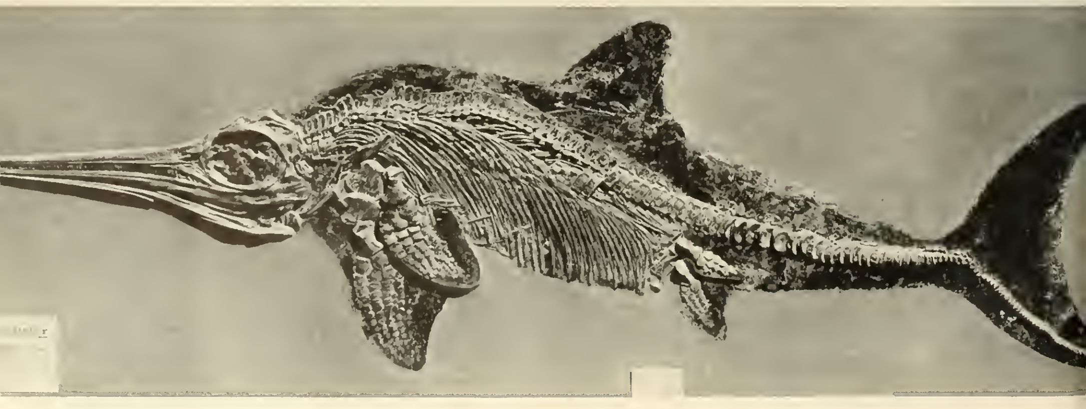
Doctor Hauff is always present when the workmen dig up a fossil in these slates. They are Jurassic slates, 130 million years or more old, belonging to the Lias, one of the three subdivisions of the Jurassic period. The subdivisions are subdivided again and are designated by Greek letters, Lias Alpha, Lias Beta, and so on. Lias Epsilon, the fifth layer—counted from the bottom—is the one where Ichthyosaurus is most abundant. The workmen know this and they are instructed to call Doctor Hauff at once when a fossil is found. They are especially proud to be able to report what kind of fossil they have found. They do not report with the scientific names, of course, they have a terminology of their own. "A beast with paddles" means an Ichthyosaurus; "a beast with paws" means a teleosaurus. A beast with paws is worth about ten times as much as a beast with paddles.

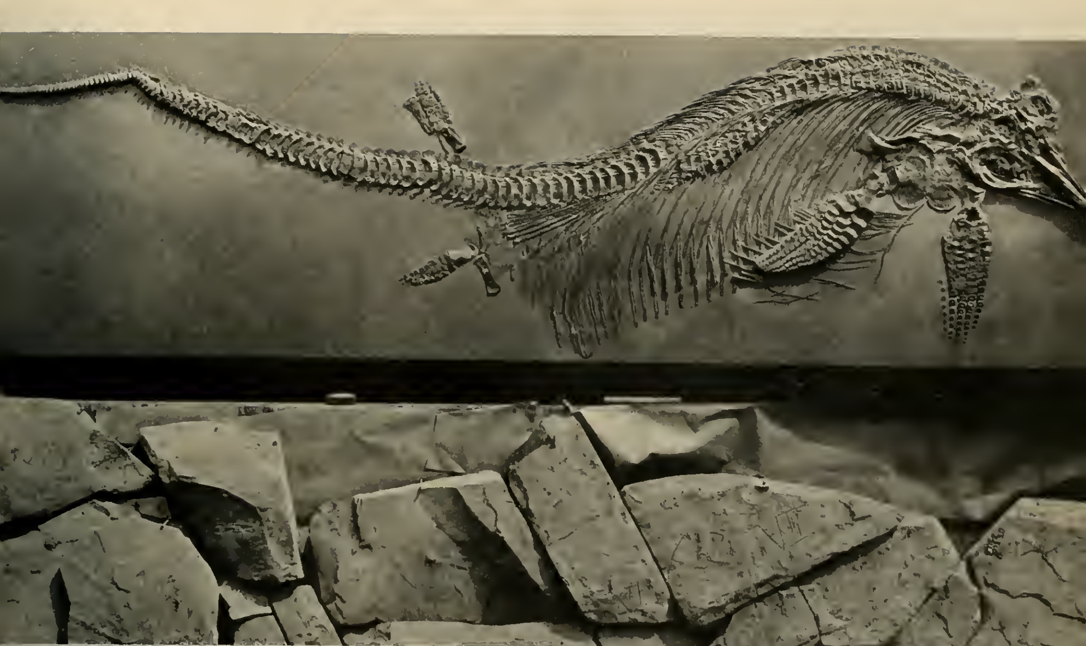
Doctor Hauff surveys the slabs of slate and de-



HOW ICHTHYOSAURS AND PLESIOSAURS were believed to look a century ago: Frontispiece of *The Book of the Great Sea-Dragons* by Thomas Hawkins, Esq., printed in London in 1840. Two plesiosaurs are attacking a hapless ichthyosaur, whose dead comrade lies a prey to flying reptiles of a type never found either fossil or alive

THE TRUE ICHTHYOSAUR with complete skin ready for exhibition in a museum. The overall length of this specimen is a little over four feet. It lived probably 130 million years ago and ate octopi, cuttlefish, the spiral shelled ammonite, and occasionally its own young





(Above) SKELETON OF AN ICHTHYOSAUR almost 12 feet long, exhibited at the Natural History Museum in Berlin. Below it are the slabs of slate as they appeared when removed from the ground

(Above) DR. BERNARD HAUFF putting the finishing touches on the skeleton of a young ichthyosaur found at the classic site near Holzmaden, Germany. Dr. Hauff is renowned for his work on this family of extinct marine reptiles

A DEATH-TRAP OF ICHTHYOSAURS: Deposits of slate at Holzmaden where hundreds of marine reptiles perished and were preserved 130 million years ago, probably owing to poisonous gases in the ancient sea. The slate is mined commercially, but the workmen know the treasures it contains and report every discovery to Doctor Hauff cides whether the remains are worth preserving. Usually he is able to tell at first glance from his long experience. About two dozen ichthyosaurians a year are judged worthy of the extra labor. It is a highly specialized work demanding unusual skill. The stone has to be scraped from the fossilized bones, grain by grain, as carefully as possible. As the task progresses the work approaches the niceties of a surgical operation and has to be done with the aid of a magnifying glass. Finally the fragments of the slab, which usually goes to pieces when it is removed from the ground, are fitted together and the long extinct reptile lies on a smooth plate of slate like the cleanly picked bones of a large fish on a platter.

Discovery

One day when doing this work Doctor Hauff had the impression that he noticed something he had never seen before. It looked as if there were a darker shade in the stone around the skeleton. When the stone was wetted the darker shade became more distinct. A hazy outline could be seen. Doctor Hauff proceeded with the utmost caution and a few weeks later he was able to announce to the scientific world that he had succeeded in finding a specimen with a sharp and clear outline of the skin.

Suddenly the real appearance of the strange animal became known. There had been a tail fin as Owen had assumed, but it was not horizontal like that of a whale. It was a vertical triangular fin, beginning at the point where the spine was seemingly broken. The spine was not actually broken, then, but only appeared so because of the extension of the triangular fin.

There was no longer any need to make many words in accounting for the strange "deformity" of the ichthyosaur. Other well preserved specimens subsequently discovered, mostly by Doctor Hauff, verified his conclusion. The strange dragon suddenly looked very familiar, like the dolphin of our seas. Most probably it lived in schools like dolphins. If a modern steamer were to meet a school of ichthyosaurs on the high seas today they would probably be mistaken for dolphins. Someone might wonder about the large dorsal fins and an attempt might be made to kill or catch one. Then the difference would become apparent, and the long jaws with their teeth would further distinguish the creature. And the strange "third eye," staring upwards from the middle of the skull, would suggest even to the casual observer that the catch was a survivor from primeval days. Unfortunately this will not happen: the ichthyosaur is extinct.

Why? We can only surmise. There are skeletons of a comparatively late variety called ophthalmosaurs, which were practically toothless, and thereby hangs a tale, or rather a theory. The ichthyosaurs were, according to this theory, beasts of prey, but their prey could neither swim away nor offer resistance. It became a lazy existence for the ichthyosaurs and they did not even need teeth in their search for food. Thus, it is argued, their teeth degenerated, just as did an original scaly armor which they are believed to have possessed much earlier. All went well until new beasts of prey made their appearance in the high seas at the dawn of the Cretaceous period. These new enemies were huge types of sharks and the terrible sea-serpent-like mosasaurs. They hunted what they could find, and against them the degenerate ichthyosaur was no longer a serious competitor in the struggle for life. As a German author, Wilhelm Bolsche, expressed it, "the formidable dragon of the early days was now only a stage dragon." Its general appearance was still the same, but it possessed neither armor nor teeth, and the whip-like tail had changed into a big soft fin. The once formidable beast of prey was now prey itself.

A submarine death valley

But how did this spot that is now called Holzmaden look when the ichthyosaurs were still alive at the time when the rocks of the Lias Epsilon were formed? We know that there existed there a bay or a sound of the Jurassic Ocean. All fossils discovered at Holzmaden are remains of marine animals. The astonishing fact is that these remains are so miraculously well preserved. There are very few other fossil beds that furnish equally well preserved prehistoric animals. Credit is due Doctor Hauff for finding the preserved outlines of the skin; but credit is due Nature that the skin was preserved in the mud that is now stone. Usually the skin of an animal does not remain intact when it floats to the bottom. If death is due to attack by enemies the body must be almost torn to pieces. Even if the creature dies by other causes there are many small hungry beasts in the mud waiting to feast upon it. Crabs sit there by the hundreds or by the thousands and go over the carcass, tearing the flesh from the bones and the bones apart if they are strong enough to do it.

None of this has been observed at Holzmaden. It looks as if some unknown force killed the saurians without damaging them and at the same time kept crabs and similar animals away.

All this has led to the belief that the bay of Holzmaden was a death trap for marine animals, a

(Continued on page 457)

THE FISHES' ART OF SELF-DEFENSE—*"A Good Defense is the Best Offense" was the trunkfish's motto 50 million years ago—and he still sticks to it. In a fish-world geared for speed and a quick getaway, he just plods along, happily secure in his clumsy ancestral armor*

By MYRON GORDON
Cornell University

FISHES had elaborate styles of personal armor long before ancient man learned to use a simple shield in self-defense.

In the days before the age of dinosaurs, the most popular of all styles in apparel for fishes was a stiff suit of bony scales, movable only along the scale's beveled edges. Then with the arrival of the huge newly evolved plesiosaurs and other fish-swallowing, bone-crushing monsters in the age of reptiles, the former advantages of protective armor were practically nil. The fishes in the Mesozoic seas faced a changing tempo. The "speed-up" movement arrived.

Predatory sharks and larger fishes swam faster after their prey. Speed, not armament, was necessary for survival. Small fishes with fast, flexible bodies, streamlined for speed and powered for a quick getaway, met the challenge of the new mode of life. They fled from the triple threat of reptiles, sharks and larger fishes. Their kind flourished and multiplied.

Out moded

Nearly all modern fishes have long since discarded the last vestiges of the ancient suits of bony armor. But the modern trunkfishes have re-adopted, with modifications, the old-fashioned, prehistoric style of armor suiting. Like up-to-date dress designers, the trunkfishes have copied merely the spirit of the old style; they have evolved entirely new methods of covering their bodies.

The scales in the trunkfish's body constitute a solid series of hard hexagonal plates, firmly joined together to form a single, inflexible bony case. A tortoise in its shell can move its head in and out and twist it, if it wishes, from side to side; but the only independent movement of the head that a trunkfish can execute, is to ogle its eyes and to pucker its lips. The head is joined immovably to the trunk.

Confined permanently within these strait-jackets of their own making, it is a mystery how trunkfishes get along. Certainly few would have predicted success for fishes outfitted with this ungainly body style of a past age in this modern world with its ferocious marauders, like barracudas and morays, and the ancient predatory sharks that continue to snatch their living from all creatures weaker than themselves.

Evolution of styles

The return of armored styles to modern fishes has its human parallel. Old-fashioned costumes of past centuries reappear with modern flares to clothe the fashionable ladies of today. And personal armor of King Arthur's day has returned in part in the bullet-proof vest and the steel helmet of the modern infantryman. One man was fascinated by this piscine-human parallelism. Bashford Dean was an expert in ichthyology. He was first of all an authority on fishes of the past and present. He knew how they lived and the factors that determined why some of them failed in the past and became extinct while others succeeded in their struggle for existence until the present day. His studies of fish armor led him to a study of evolution of human armor. Dean took time off from his duties as curator of fishes at the American Museum of Natural History to establish and study the collection of human armor at the Metropolitan Museum of Art. He had long been an expert on the kinds of metallic suits of armor well-dressed knights wore in medieval times. He was appointed curator of human armor at the Metropolitan Museum of Art.

The story of evolution of armor among men is more complete than the story of evolution of armor in fishes. The human record is infinitely shorter, the number of styles invented by man are fewer, and the materials used are simpler in composition. But the development of both piscine and human armor have had their period of crude beginnings, their period of rapid development, their period of florescence, and finally their period of decline almost to the point of extinction. Trunkfish and men in bullet-proof vests are modern representatives of different ancestral stocks, but their costumes have a common purpose.

The porcupine fish's scales are modified and form a globular series of sharply pointed spines. These jagged needles form an effective coat of mail and oppose the enemy from all points of the compass. The South American armored catfish, on the other hand, is literally sandwiched in between two solid plates of bone. The unfishlike sea horses, that swim so slowly and gracefully through the water by imperceptible movement of their semi-transparent fins, are encased within a series of bony rings. Their heads are constantly erect like the heads of trotting horses on parade. Sea horses need no over-check straps to keep their heads up: their necks are encircled with collars of bone. They are stiff-necked from the cradle to the grave. When dead, their bodies, or rather their bony shells, shrink hardly at all; and dried sea horses are sometimes marketed as curios. The helpless fish are caught, their bodies dried in the sun and preserved by a coat of shellac. Thus the armor which normally serves to protect the fish becomes its tomb. Some curio vendors sacrilegiously lacquer and paint sea horses with gaudy colors.

The trigger fishes of the tropics have many small, hard, stud-like tubercles in their skin. They are tough-skinned, indeed; but their pugnacious relatives, the file-fishes, are even tougher. As a matter of fact, the skins of larger file-fishes, when peeled from their carcasses and dried, are actually used as abrasives. But all these fishes with tough hides are amateurs in the art of passive self-defense when compared with the trunkfishes, for these have the most completely enclosed of all the styles of protective armor.

Fishes' style center

The trunkfish and their allies live in the coral community of tropical American waters. The seas about the coral archipelago of the Florida Keys is a Paris style-center in the fishes' world. Man lacks the imagination to design the diversity of outlandish styles displayed by the fishes in this marine style-center. A menagerie of fish types pass constantly in review. There are sea horses, of course; then there are pork fish, goat fish and mutton fish; then there are squirrel fish, rabbit fish and lion fish; there are scorpion fish, louse fish and butterfly fish; parrot fish and snipe fish; frog fish, snake fish and lizard fish; and there are monk fish and angle fish! And, to return to the category of trunkfish, there are cowfish.

No contest was ever proposed, no prizes were ever offered for the best choice of a name to suit the personality of the cowfish, a trunkfish which scientists call *Lactophrys tricornis*. If there had been a contest, perhaps someone might have thought of a more dignified name. And yet these curious twelve-inch fishes of the coral reefs do resemble, in a most superficial manner to be sure, a staid milch cow. They have the same wide-eyed, vacuous expression, although on rare occasions they seem to express a mood of deep sadness. When disturbed they appear to be bewildered and amazed.

William Swainson, the English naturalist, writing in 1839, must have had an amusing time in choosing the cowfish's technical name of *Lactophrys*. The horn-like protuberances must have reminded him of a cow. That would account for the "lacto" portion of *Lactophrys*, for "lactoria" means milch cow in Latin. Then there was something appealing about the sad eyes of the cowfish, something about their overhanging, brooding, eyebrow-like eye-sockets that attracted Swainson's sensitive attention, so that he added "ophrys", which means eyebrow in Greek. Could Swainson have meant, then, that this mournful fish looked like a cow with prominent eyebrows? *Tricornis*, the cowfish's specific name, refers to three horns. Actually the cowfish, like its bovine namesake, has but two horns on its head; but in addition, in the rear pointing backward, there are three horns on each side of the shell.

You might think that the ichthyologist is bothered by such names as *Lactophrys tricornis* for the cowfish and *Lactophrys trigonus* for the common trunkfish, but as a matter of fact the fish scientist is happy about it. Years ago, in 1738, toward the end of the dark ages of biology, the educated fish man had to remember this name for the cowfish: *Ostracion triangulatus duobus aculeis in fronte et totidem in imo ventre subcaudalesque binis*. The author of this prayer-like appellation was Pedrus Artedi, a native of Sweden.

Fish hunting in taverns

Artedi had traveled widely in his lifetime. When in England he made the rounds of the taverns in and about London. He specifically mentions "The Nagg's Head", "The White Bear" and the "Green Dragon in Stepney." These visits were strictly on business for it was in these and other inns that various natural history curiosities from the new world of America were exhibited. The trunkfishes as a group became well known to European naturalists because of the heavy demand for, and the extensive traffic in, the dried shells of these fishes. So thorough were the catches of trunkfish hunters in American seas that every species now recognized as distinct had been described some two hundred years ago from curio specimens.

It was at the height of this trunkfish curio fad period that Artedi described several of them. In London Artedi visited Sir Hans Sloane and saw his collection of natural history specimens from the

West Indies, a collection which was destined to be the beginning of the British Museum of Natural History. There Artedi spotted a rare cowfish. He was convinced that this particular cowfish had never before been recognized or described to the scientific world. Forthwith he supplied the necessary baptismal papers. The words he used were in Latin, the language in vogue at the time for scientific treatises. From that baptismal record, the name *Ostracion triangulatus duobus*, etc. of the cowfish was derived.

But the records show that Pedrus Artedi was fifty years too late in his naming of the cowfish. He was beaten by Dr. Martin Lister, who is not to be confused with Lord Lister of antiseptic fame. Dr. Martin Lister, the original cowfish man, had his own ideas about names for the cowfish. His 1686 name is: *Piscis triangularis capite cornutus cui e media cauda cutacea aculeus longue erigitus.* Lister's and Artedi's names for the cowfish stood on the fish catalogues until 1758, when von Linné gave naturalists the world over a new deal by systematically cutting down the long names of all living things to two words. All naturalists cheered. This practice is still in vogue today. When the modern naturalist thinks back to the days of Lister and Artedi and recalls the long quotations these gentlemen used as names for their specimens, he feels that remembering and saying *Lactophrys tricornis* is almost as easy as saying Jack Robinson.

But the honor of having discovered the very first American trunkfish must go, not to Dr. Martin Lister or Pedrus Artedi, but to an unknown member of Columbus' crew. On their first voyage to America in 1492, while at anchor on the coast of Cuba, this unknown sailor-fisherman caught a fish which "was like a swine, all covered with a very hard skin, no part whereof was soft but the tail."

Can change color

Others fishes may have shapes that please the human eye better than the angular conformations of the trunkfish, but no fish can claim more dazzling colors, a more intriguing color pattern, and a greater repertoire of color changes than they.

England's fish expert, J. R. Norman, keeper of fishes at the British Museum, votes the trunkfish of the Great Barrier Reef of Australia the most colorful of all fishes. They have all the colors of the rainbow and can change at will from one color scheme to another. The Florida trunkfishes are brilliant, too, and their remarkable ability to change color is manifest when at one moment they are vivid green, at the next a nut-brown, and a moment later as white as the bleached coral sand. And in the intervals between these definite color phases, intermediate transitional stages are flashed in a continuous series of complex combinations.

There certainly is no correlation at all between their beautiful colors and beauty of body lines for they are grotesque and unbelievable. Detached from their normal surroundings they appear clownishly out of place. But swimming slowly among the living coral heads they are dignified and even stately. Their bodies can never relax from their stiff-necked posture, for they are of one piece. When forced to rapid movement they are ludicrous. They have penguin-on-land actions in getting about.

When removed from the water their behavior is pathetic, for they are absolutely helpless, being unable to move their solid bodies. When placed upon a stone, out of water, trunkfishes foam at the mouth in their distress. Some say that they make small grunting noises; others say that they growl like dogs. Large trunkfishes will live two to three hours out of water, all the time, Goode comments, "solemnly fanning their fins". When restored to their native element they cannot immediately sink to the bottom for they have absorbed much air in their sojourn above the water line; but after a short time they seem none the worse for their emersion.

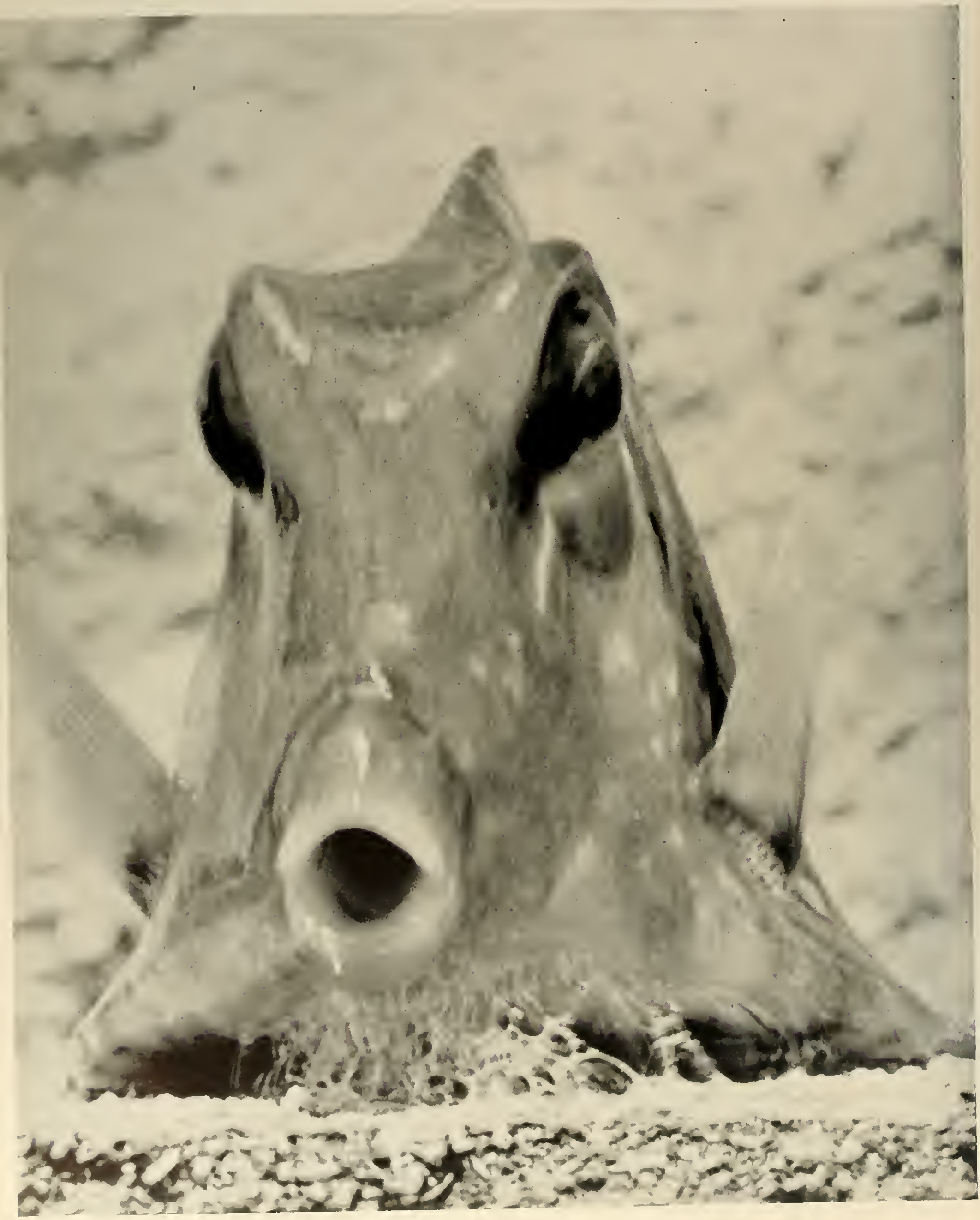
Face

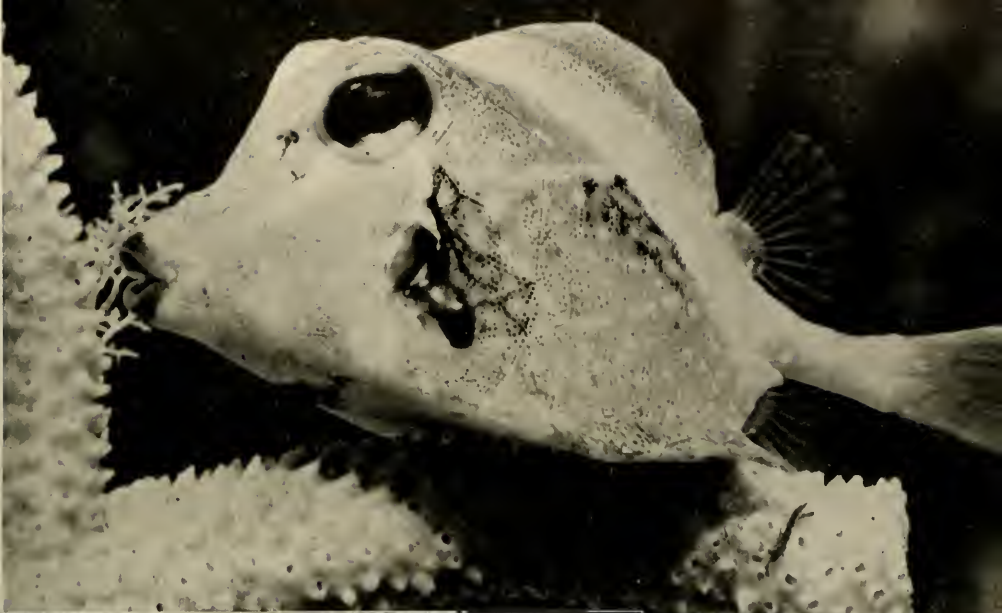
Viewed head-on the chinless face of a trunkfish presents a grotesque appearance, with its lips perpetually pursed as if forever ready to kiss the world. From their funnel-shaped head small jaws protrude which are capable of limited movement only. They have a strong set of teeth, designed to break down hard coral structures which are inhabited by worms, shrimps and other small animals on which they feed. With these powerful teeth they can defend themselves from smaller fishes at close quarters, but in the confinement of an aquarium the trunkfish is at a distinct disadvantage. Its fins are constantly being ripped to pieces by fishes that are in the habit of biting at anything that moves and then darting away. Trunkfish have lived for long periods in an aquarium, but their cell-mates have been chosen with great care.

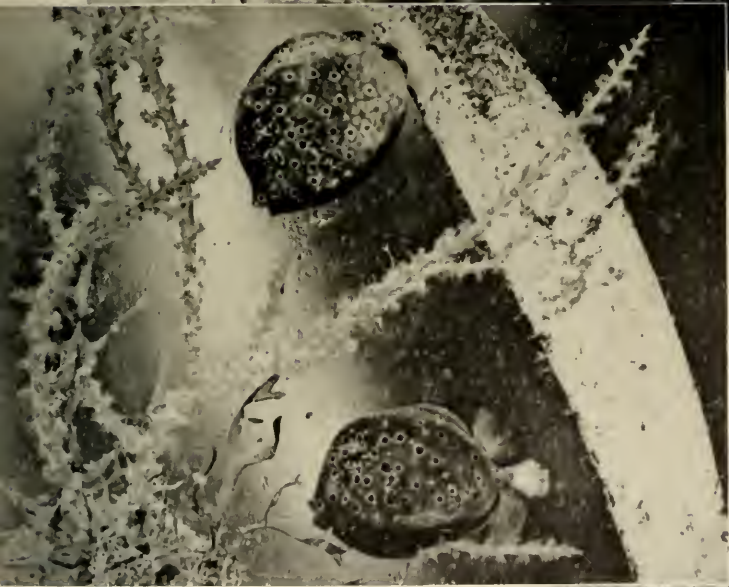
Trunkfishes have regained a degree of protection within their rigid bony shell but only at the expense of speed. They do not have the smooth contours and perfect tear-drop streamline form displayed by fast-swimming fishes like mackerel and swordfish. Rather their body styles follow motifs of sharp angles, pointed projections and grotesque elevations, all moulded into a single bony frame. Cleave a swordfish in two behind the head and the outline of the

The Fishes' Art of Self-defense

COMPLETELY ENCASED IN ARMOR, the awkward little trunkfish is like an armored knight of old, seemingly out of place in this modern world that is geared for speed and a quick getaway. For fifty million years this fish has followed the motto that a good defense is the best offense. While most fishes have discarded their ancient heavy suits of armor the trunkfish has readopted the old style





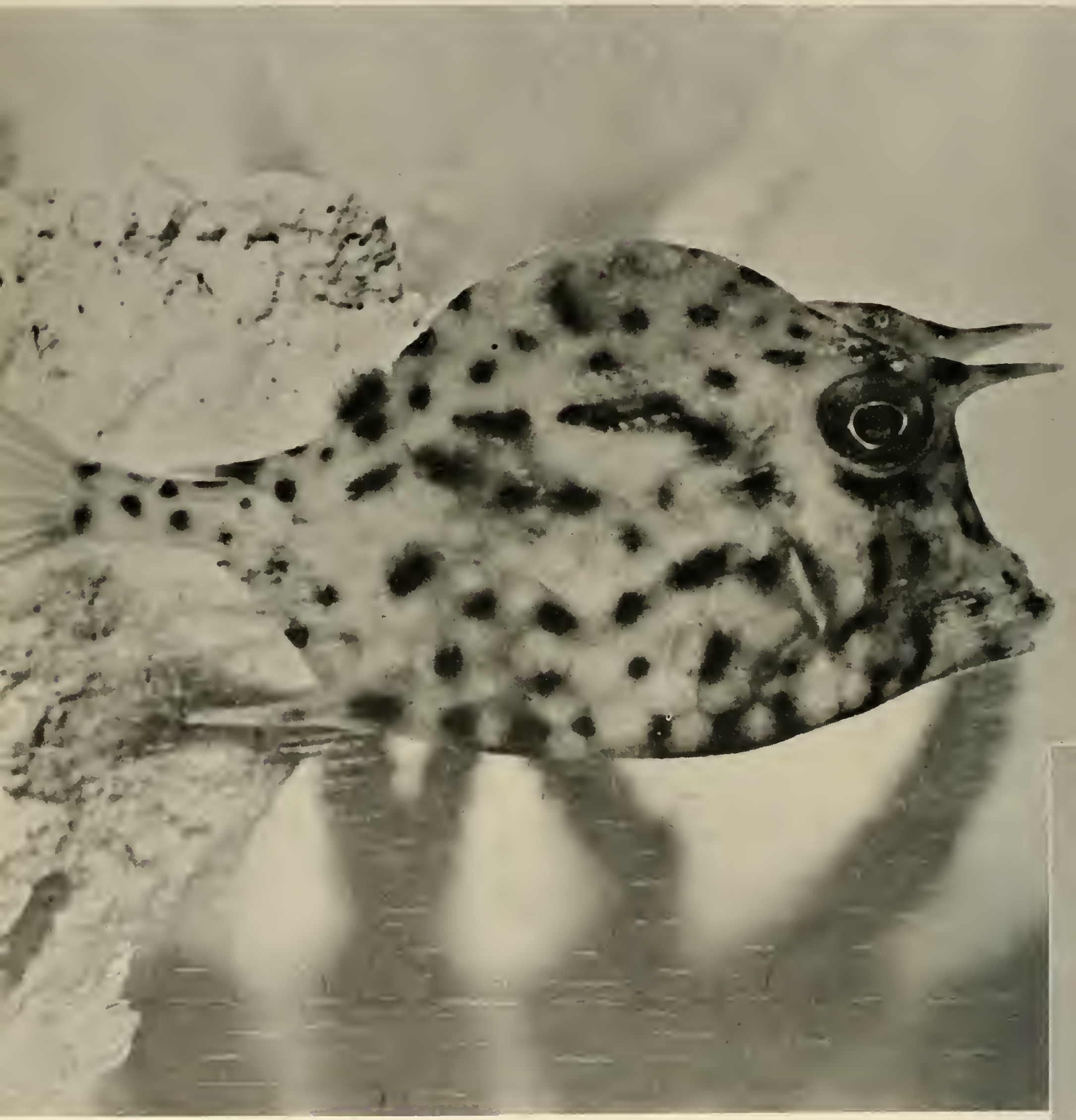


(Above) THE SMALL JAWS of the trunkfish are capable of limited movement only, but they have a strong set of teeth designed to break down hard coral hiding-places of worms, shrimps and other tiny sea creatures upon which the fish feeds. The trunkfish's head is joined immovably to the trunk and it can only ogle its eyes, pucker its lips and move its whisk-broom tail and fins. It may not be graceful, but no other fish can display more dazzling colors. It is one of the most beautifully colored fishes of our tropical waters and it can change from one color scheme to another

(Above) THE FIRST PUBLISHED PHOTOGRAPH of a baby trunkfish. In the watery paths among the living coral heads and encrusted turtle grass, the trunkfish is fairly safe, but if it strays into the highway of the Gulf Stream it is swept into a region patrolled by sharks, barracudas and other sea marauders that are always ready to pounce upon it

(Right) A SOLID SERIES OF HARD PLATES forms the trunkfish's armor. Out of water it is pathetically helpless, but in its native element, it is dignified and stately as it swims slowly. When forced to swim rapidly, its rudder-like tail fin goes into action and looks like a man frantically sculling a flat bottomed row-boat

Cowfish, a type of trunkfish. Perhaps this denizen of the coral reefs has earned its name because of its wide-eyed, vacuous expression and superficial resemblance to a staid milch cow. Here the cowfish displays what appears to human eyes to be a mood of distinct sadness. So great was the demand for dried trunkfish shells by curio collectors that every species now recognized had been described some 200 years ago



WHEN DISTURBED the cowfish appears bewildered and amazed. The cowfish was first identified in 1686. But to an unknown member of Columbus' crew must go the credit for discovering the first American trunkfish, which he described as being "like a swine, all covered with a very hard skin, no part whereof was soft but the tail"

BABY COWFISH: a young inhabitant of that Paris style-center of the fish world, the Florida Keys. Like other trunkfish, the cowfish has sacrificed speed for security. With nothing to tempt a small pursuer, it is not likely to be attacked except by fish that can swallow it whole, and these it avoids by keeping to the narrow passageways of the coral community

cut is an oval. Split a trunkfish similarly and the outline is a triangle. The back of the swordfish is nicely curved; the back of the trunkfish is a pyramid. The belly of the swordfish is well rounded like the bottom of a trim, speedy canoe; the belly region of a trunkfish is as level as the underside of a flat-bottomed rowboat. This flat nether surface enables the trunkfish to execute a safe, upright landing on the bottom of the sea; and here it spends much time resting quietly.

Locomotion

Living their lives encased permanently in bony armor these small, individual, aquatic tanks, being unable to execute body undulations, move slowly through the water, relying upon their fins alone to project them forward. From the rigid case, and joined to it by thin folds of skin, project small, flabby fins; one on each side of the body, one on top, and one on the bottom. From the rear a thin, naked tailpiece with its ridiculously small flap of tail fin sticks out like a stiff whisk-broom tail on a hobby horse. This fin, so important in other fishes' swimming strokes, merely serves the trunkfish as a rudder. Only when the trunkfish is pressed for utmost haste does its tail revert to the time-honored task of active locomotion. When forced, it will lash its tail from side to side in the best fish manner. In doing this the motion of its tail fin may be likened to the sculling action of the gondolier's single oar at the stern of his boat.

The burden of locomotion falls upon the small upper and lower fins. These have a half rotary sculling action resembling, but, of course, never effecting, the movement of a screw propeller. Oftentimes the movement of these transparent fins is hardly perceptible and the chunky trunkfish seems to glide through the water without effort and with great dignity.

The fins on the port and starboard side of a trunkfish have a special duty. They not only keep the fish upright but they prevent it from being projected forward like a rocket by the powerful force of the water ejected backward from the small gill openings. When the fish is at rest the pectoral fins wave vigorously at the rate of one hundred and eighty times a minute.

Trunkfish have put their trust in the principle that a strong defense is the best offense. They have been practicing this policy successfully for the past fifty million years. This may seem a long time for humans, but the modern age for fishes started millions of years before the form of man was conceived.

There is no question, as far as trunkfishes are concerned, that the exchange of speed for security was profitable. They are not likely to be attacked by fishes of their own size, with which they have to compete most of the time. The trunkfish live among the living coral heads in tropic seas, among which the watery paths are often narrow and tortuous. A coral reef community is a city of narrow streets and crooked alleys. The denizens of the coral city rarely stray into the boulevards and highways of open water. If they do, they are soon taken out of their native course: the Gulf Stream will carry them to northern waters that are colder and uncongenial. They cannot live a normal life outside their coral community. Sharks, barracudas, and other predators of the sea patrol the outskirts and await their chance to pounce, unhindered by the many pillars and posts within the coral city, upon those that stray outside.

Evidence from shark's stomach

Shark stomachs tell stories that cannot be denied. Sharks have swallowed trunkfish. Unless trunkfish are swallowed whole they are not likely to be attacked at all. What, after all, has the trunkfish to tempt its smaller pursuers? Its fins are thin and small. Its tailpiece is a little insignificant morsel of flesh hardly worth the effort of a fight. And the trunkfish has a strong set of teeth with which it can defend itself at close quarters. But it cannot defend itself as it passes down the gullet of a shark. Gudger, American Museum fish expert, found an empty and perfectly polished shell of a trunkfish inside the stomach of a shark at Dry Tortugas, Florida. The six-sided, fused plates of the unfortunate trunkfish's bony jacket were worn down so smooth that they revealed their beautiful mosaic construction. The fine striations and scrolls upon each piece appeared as clear as the grain in a slab of well-rubbed curly maple. Sharks have an efficient digestive mill to handle these tough but tempting morsels. When a shark is through with a trunkfish it discards a shell that is as completely freed of soft parts as a skeleton that has been picked clean by the combined efforts of buzzards, ants and dermestids, experts in this funereal job.

Sharks discovered that trunkfishes were good eating long before man did—long before man existed. Even now sharks are beating man in trunkfish hunting—they are nearer the source of supply. Trunkfish are a treat for the epicure, according to America's expert in fisheries, G. Brown Goode. Serious cases of poisoning have resulted from eating the spoiled meat of the trunkfish, but these cases occurred in tropical countries where, if care is not taken, the flesh decomposes rapidly. There is little danger of poisoning if the fish are fresh. Seafood connoisseur

Goode says that the flesh of these fishes is delicate in texture and exceptionally pleasant in taste. Goode likes his fishes prepared by first boiling them whole, like lobsters, in salt water, then scooping out the meat; the meat is then mixed with cracker crumbs, eggs, butter and red pepper, and this promising combination is stuffed back into the original trunkfish shell and roasted until nicely browned. Those who have eaten this fish agree with Goode that it is a rare delicacy. Trunkfish eating has not reached commercial proportions as yet. Some enterprising composer of sea food menus could scoop the shore dinner trade by glorifying them as the treasure-chests of the sea.

So enthusiastic was the French fish scientist and fish gourmet, Lacepédè, of the delicacy of the flesh of the trunkfish that he wrote at great length, in 1798, of a method by which the trunkfish of the American tropical seas might be induced to live in the temperate fresh waters of France. "The exquisite flavor and exceedingly wholesome nature of the flesh of the 'triangulaire' should encourage us to make persevering and well considered experiments in this direction". His plan was to acclimatize the fish by gradual, insensible changes in temperature and salinity of the sea water until the cool, fresh water level was reached. There was one serious difficulty to this plan: the trunkfish refused stubbornly to cooperate.

European waters do not provide the coral homesteads necessary for the trunkfishes, and none are found along European coasts of the Atlantic. But the tropical shores of the American Atlantic provide suitable places for them, and here they flourish. They are abundant in the vicinity of the laboratories of the Marine Biological Station of the Carnegie Institute at Loggerhead Key of the Dry Tortugas, the last of the Keys of Florida.

In the trunkfish's haunts

One day in the shallow seas surrounding Bush Key, just opposite Garden Key or Fort Jefferson, the "Shark Island" of Dr. Samuel Mudd fame, we hauled a fine-meshed seine at low tide along the outskirts of a fine stand of living coral heads. We walked shoulder-high in the warm, crystal-clear waters, scarcely seeing the well-camouflaged sea creatures that we knew were there. We worked blindly in our attempt to surround a section of the coral community and capture its inhabitants. Three of us dragged the seine for some thirty yards toward still shallower waters at the beach. Then those on opposite ends of the seine approached one another in a circling maneuver, and gradually the net completely surrounded a crowded, milling mob of fish, crabs, shrimps, sea urchins, sea cucumbers, snails, sponges, algae of all shapes and colors. Everything was entwined in strands of fantastic seaweeds, bits of broken coral, and masses of sponges.

Animal or vegetable?

We were obliged to remove these entwining objects before we could safely select the living fishes we wanted for closer study. As we hauled out pieces of seaweeds of many colors and curious designs, I noticed a number of green globules of jelly-like algae, suspended in the water enclosed by the net. They moved almost imperceptibly, as if carried by the tide. As I reached down to remove these bits of plant masses, they moved a trifle faster than my open hand. I tried again, with the same empty result; then it dawned upon me that those globs of algae were not algae at all but were some form of animal life. I made a deliberate lunge at one of them and found that I had a baby trunkfish in my hand.

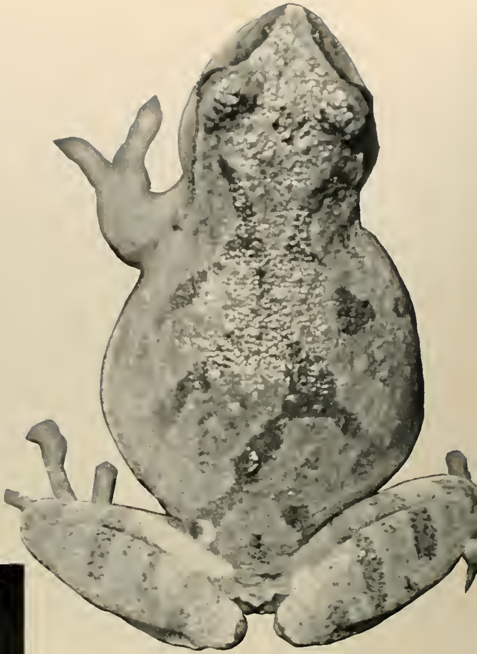
My first impression of having to deal with green masses of plant life was so strong that the realization that they were representatives of the animal world came as a definite mental shock. I had the sensation for an instant of acting as a magician and at the same time of being one whom the magician held spellbound. It was almost as if I had pulled a rabbit out of the net.

I looked at the baby trunkfish again. Its body was already hardened with bone and its small mosaic green shell was beautifully sculptured in an intricate design that followed a hexagonal pattern. Its tiny, transparent fins were hardly visible in my hand; they were entirely invisible in the water. It was these translucent fins that had enabled the little trunkfish to move away in an unfishlike manner from my hand. When I replaced it in the water, the little green fishy ball made off with the smoothness of a toy balloon in a quiet breeze.

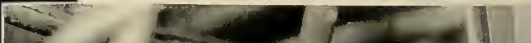
Peeper Hunting

By FRANK GEHR

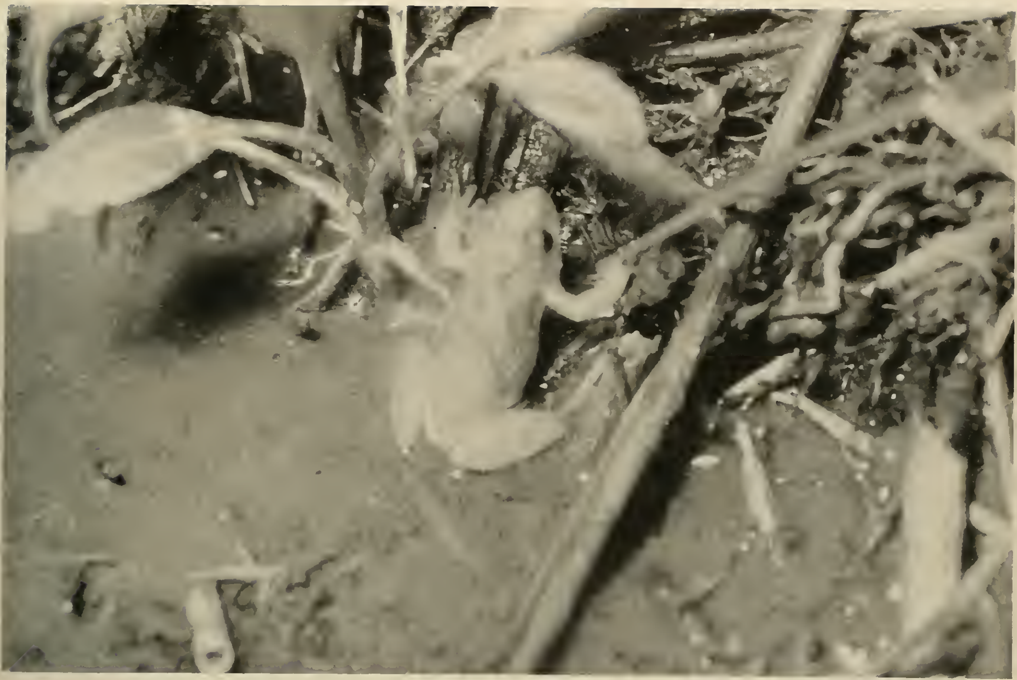
THE BULB-THROATED TREE FROGS called peepers are often heard but rarely seen. Their springtime chorus in the lowlands, which sounds like a distant jingling of sleigh bells, travels incredibly far, and the individual peeper is difficult to locate. Frank Gehr, who provides NATURAL HISTORY with these unusual pictures, is assisted by his well-trained German Shepherd dog in the hunting and photographing of peepers. Even when peepers are scarce, as in the fall of the year, and when human searchers working in unison have failed to locate them, the command "Go find the peeper!" is sufficient to send the peeper-hound quickly to his strange little quarry



DESPITE ALL THE NOISE they make, the peepers are only about an inch long. They are identified by the dark markings shown above, which render them almost invisible against their customary background, and by the angular ridges running from each eye to the nose

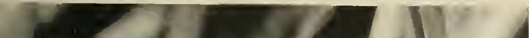


THE BEGINNING OF A PEEP. With mouth held shut, the frog forces air through its vocal chords into the pouch under its throat

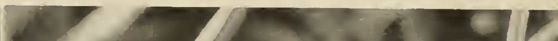


NOT AN ALBINO but merely a pale peeper. His light-gray, translucent skin will take on the camouflage coloration of his kind under different conditions of light and moisture, owing to expansion and contraction of the pigment cells

Their elusive habits make the peepers difficult to photograph and protect them from the numerous animals which prey upon them. One peeper which was posing for Mr. Gehr was suddenly whisked away by a common water beetle



THE POUCH EXPANDS during the note and acts as a sounding board and amplifier, throwing the sound unbelievable distances



FULLY EXPANDED, the pouch is sometimes larger than the body itself. Thousands of peepers are unregistered residents of city parks

IN MEMORY OF

William Morton Wheeler

Late Research Associate in Social Insects, American Museum of Natural History

The following selection* from this distinguished entomologist's own writings is reprinted here as a memorial to his scientific and philosophical genius.

It is a letter from the king of a hypothetical termite kingdom, who speaks for the efficient social behavior of these insects and suggests parallel methods for correcting some of the social evils that confront the human race.

Dear Sir:

According to tradition our ancestors were descended in early Cretaceous times from certain kind-hearted old cockroaches that lived in logs and fed on rotten wood and mud. Their progeny, the aboriginal termites, although at first confined to this apparently unpromising diet, made two important discoveries. First, they chanced to pick up a miscellaneous assortment of Protozoa and Bacteria and adopted them as an intestinal fauna and flora, because they were able to render the rotten wood and mud more easily digestible. The second discovery, more important but quite as incidental, was nothing less than society. Our ancestors, like other solitary insects, originally set their offspring adrift to shift for themselves as soon as they hatched, but it was found that the fatty dermal secretions, or exudates of the young, were a delicious food and that the parents could reciprocate with similar exudates as well as with regurgitated, predigested cellulose. Thenceforth parents and offspring no longer lived apart, for an elaborate exchange of exudates, veritable social hormones, was developed, which, continually circulating through the community, bound all its individuals together in one blissful, indissoluble, syntrophic whole, satisfied to make the comminution and digestion of wood and mud the serious occupation of existence, but the swapping of exudates the delight of every leisure moment. . . .

You will admit that no society could have embarked on its career through the ages with more brilliant prospects. The world was full of rotten wood and mud and no laws interfered with distilling and imbibing the social hormones. But in the Midcretaceous our ancestors struck a snag. Not only had all the members of our society begun to reproduce in the wildest and most unregulated manner, but their behavior toward one another had undergone a deterioration most shocking to behold. The priests, pedagogues, politicians and journalists having bored their way up to the highest stratum of the society undertook to influence or control all the activities of its members. . . . The politicians and the journalists . . . secreted such a quantity of buncombe and flapdoodle that they wellnigh asphyxiated the whole termitarium. Meanwhile in the very foundations of the commonwealth anarchists, syndicalists, I. W. W. and bolsheviki were busy boring holes and filling them with dynamite, while the remainder of society was largely composed of profiteers, grafters, shysters, drug-fiends and criminals of all sizes interspersed with beautifully graduated series of wowsers, morons, feebleminded, idiots and insane. [At this point the king has introduced a rather trivial note on the word "wowser." This word, he says, was first employed by the termites of Australia but later adopted by the human inhabitants of that continent, to designate an individual who makes a business of taking the joy out of life.]

. . . The few sane termites still extant were on the point of giving up a social life altogether and of returning to the solitary habits of the Palaeodictyoptera, but a king, Wuf-Wuf IV., of the 529th dynasty, succeeded in initiating those reforms which led our ancestors to complete the most highly integrated social organization on the planet. . . . This king had the happy thought to refer the problems of social reform to the biologists. They were unfortunately few in number and difficult to find, because each was sitting in his hole in some remote corner of the termitarium, boring away in blissful ignorance of the depravity of the society to which he belonged. In obedience to the king's request, however, they were finally rounded up and persuaded to meet together annually just after the winter solstice. . . . After doing this for ten million years they adopted a program as elegant as it was drastic for the regeneration of termite society . . . dividing it into three distinct castes, according to the three fundamental organismal needs and functions, the workers being primarily nutritive, the soldiers defensive and the royal couple reproductive. . . .

It is, of course, one thing to have a policy and quite another to carry it out. The anarchistic elements in our late Cretaceous society were so numerous and so active that great difficulty was at first experienced in putting the theories of the biological reformers into practice, but eventually, just before the Eocene Tertiary, a very effective method of dealing with any termite that attempted to depart from the standards of the most perfect social behavior was discovered and rigorously applied. The culprit was haled before the committee of biochemists who carefully weighed and examined him and stamped on his abdomen the number of his colloidal molecules. This number was taken to signify that his conduct had reduced his social usefulness to the amount of fat and proteins in his constitution. He was then led forth into the general assembly, dismembered and devoured by his fellows. . . .

Now I beg you to note how satisfactory was our solution of the many problems with which all animals that

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*Abridged from the *Scientific Monthly*, February, 1920; later published in *Foibles of Insects and Men*, by William Morton Wheeler, 1928, Alfred A. Knopf, Inc.

become social are confronted. I need not emphasize the matter of nutrition, for you would scarcely contend that animals that can digest rotten wood and mud, grow perennial crops of mushrooms on their excrement, domesticate strange animals to serve as animated distilleries and digest not only one anothers' bodies but even one anothers' secretions, have anything to learn in dietetics or food conservation. Our solution of the great problems of reproduction, notably those of eugenics, is if anything, even more admirable, for by confining reproduction to a special caste, by feeding it and the young of the other castes on a peculiarly vitaminous diet and by promptly and deftly eliminating all abnormalities, we have been able to secure a physically and mentally perfect race. You will appreciate the force of this statement when I tell you that in a recent census of the 236,498 individuals comprising the entire population of my termitarium, I found none that had hatched with more than the normal number of antennal joints or even with a misplaced macrochaeta. . . . The problem of social protection was solved by the creation of a small standing army of cool-headed, courageous soldiers, to be employed not in waging war but solely for defensive purposes, and the development on the part of the soldiers and workers of ability to construct powerful fortifications. It may be said that the formation of the soldier caste as well as the invention of our cement subway architecture—an architecture unsurpassed in magnitude, strength and beauty, considering the small stature of our laborers and the simple tools they employ—was due to the repeated failures, extending over many million years, of our politicians to form a league of nations with our deadly enemies, the ants. . . .

Such was our society at the beginning of the Eocene, and such with slight improvements in detail, it has remained for the past fifty million years, living and working with perfect smoothness, as if on carefully lubricated ball-bearings. . . .

You will pardon me if after this hasty sketch of our history I am emboldened to make a few remarks about your society . . . I must confess that to me your society wears a strangely immature and at the same time senile aspect, the appearance, in fact, of a chimera, composed of the parts of an infant and those of a white-haired octogenarian. Although your species has been in existence little more than one hundredth of the time covered by our evolution, you are nevertheless such huge and gifted animals, that it is surprising to find you in so imperfect a stage of socialization. . . . And owing to the absence of eugenics and birth-control and to your habit of fostering all weak and inefficient individuals, there is not even the dubious and slow-working apparatus of natural selection to provide for the organic fixation of castes through heredity. . . .

But the senile aspect of your society impresses me as even more extraordinary, because our society—and the same is true of that of all other social insects—is perennially youthful and vigorous, owing to our speedy elimination of the old and infirm. . . . To be explicit, it seems that though your society has no true caste system, it is, nevertheless, divided into what might be called three spurious castes, the young, the mature and the aged. . . . To avoid shocking your human sensibilities, I am willing to admit that the young and aged may be worth all the care that is bestowed on them, the young on account of their promise and the old on account of past services. . . . But, writing as one animal to another, I confess that I am unable to understand why you place the control of your society so completely in the hands of your aged caste. Your society is actually dominated by the superannuated, by old priests, old pedagogues, old politicians and no end of old wowsers of both sexes who are forever suppressing or regulating everything. . . .

I notice that your educators, psychologists and statisticians have much to say on human longevity, and you seem all to crave for nothing so much as an inordinate protraction of your egos. Psychologically, this is, of course, merely another manifestation of your fundamentally unsocial and individualistic appetites. . . .

It will probably be found that many of your aged are of no economic importance whatever, and that the activities of many others may even be mildly helpful or beneficial, but you will find, as we found in the Midcretaceous, a small percentage, powerful and pernicious out of all proportion to their numbers, who are directly responsible for the deplorable inertia of your institutions, especially of your churches, universities and political bodies. These old individuals combine with a surprising physical vigor a certain sadistic obstinacy which consecrates itself to obstructing, circumventing, suppressing or destroying not only everything young or new, but everything any other old individual in their environment may suggest. . . .

It has sometimes occurred to me that your social problem may be quite insoluble—that when your troglodyte ancestors first expanded the family and clan into society they were already too long-lived, too "tough" and too specialized mentally and physically ever to develop the fine adjustments demanded by an ideal social organization. I feel certain, nevertheless, that you could form a much better society than the present if you could be convinced that your further progress depends on solving the fundamental, preliminary problems of nutrition, reproduction and social defense, which our ancestors so successfully solved in the late Cretaceous. These problems are, of course, extremely complicated in your society. Under nutrition you would have to include raw materials and fuel, *i.e.,* food for your factories and furnaces as well as food for your bodies. Your problems of reproduction comprise not only those of your own species but of all your domesticated animals and plants, and your social defense problems embrace not only protection from the enemies of your own species (military science) but from the innumerable other organic species which attack your domesticated animals, and plants as well as your own bodies. . . . Like our ancestors you will certainly find that these problems can be solved only by the biologists—taking the word "biologists" in its very broadest sense, to include also the psychologists and anthropologists—and that till they have put their best efforts into the solution your theologians, philosophers, jurists and politicians will continue to add to the existing confusion of your social organization. It is my opinion, therefore, that if you will only increase your biological investigators a hundredfold, put them in positions of trust and responsibility much more often and before they are too old, and pay them at least as well as you are paying your plumbers and bricklayers, you may look forward to making as much social progress in the next three centuries as you have made since the Pleistocene. That some such opinion may also be entertained by some of your statesmen sometime before the end of the present geological age, is the sincere wish of

Yours truly,

Wee-Wee, Neotenic King,
of the 8,429th Dynasty of the Bellicose Termites.

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THE INDOOR EXPLORER

By D. R. Barton

Laboratory On Wheels: At the American Museum, summer brings with it many occupational changes. Workers in various scientific fields give up their painstaking analysis, cataloging, and describing of species and, leaving the comparatively cool halls and laboratories, make their way to sun-baked deserts, wind-swept mountains, or deep-flowing waterways. There they seek out hitherto uncollected specimens of the fauna to the investigation of which their lives are devoted.

From the time that the Museum first began to send out expeditions, its operatives have looked upon their field work with mingled pleasurable anticipation and the apprehension that comes when you realize that many irksome experiences lie before you. Collecting expeditions are inevitably harassed by grueling manual labor, the necessity of becoming quickly accustomed to sudden climatic changes and the ability to go without nearly all the creature comforts associated with civilized communities.

To do this sort of work you must not only be prepared to live a rough outdoor life, but you must develop to the point of artistry the skill of authentically preserving specimens which, once killed, will rapidly deteriorate even in fairly cool climates. An expedition leader must organize his work with something of the precision that a general employs in planning a military campaign. With respect to food and water supply, transportation lines and baggage, the problems of the general and the expedition leader are almost identical. And the hunting, capture and preservation of the specimens requires a meticulous attention to detail that some military commanders of history might well have emulated.

Like an army, an expedition moves on its stomach. Expeditions have always been hampered by shortages of food and water, by the heaviness of their equipment, by unforeseen accidents to their pack animals and personnel, by exasperating time losses in making and breaking camp, and by sickness resulting from the hazards of tent life in strange climates for weeks on end.

The summer of 1937 will be remarkable in Museum expedition work because Dr. Harold Anthony, Curator of the Mammal Department plans to introduce an experimental innovation in expedition technique which he hopes will remove or alleviate many of the difficulties that have curtailed expeditions of the past and detracted from the value of their findings. He plans to press into Museum service a locomotive invention or rather development, which has lately come in for a good deal of well-earned publicity.

Two or three years ago, a mild form of mania swept through almost every section of the United States—it was the trailer craze. Many publications were deluged with articles telling strange tales of vast segments of the depression-ridden population hitching up factory-produced or home-made trailers to their automobiles and forming, almost overnight, a nomad population that thronged all highways the country over. Men in the public eye were alarmed and pointed trembling fingers toward the day when America would give up the idea of permanent residences altogether and become a rootless nation living on wheels. After the first wave of speculation as to the dire complications resulting from the introduction of this new and curious vehicle into the American way of life, several investigations were conducted by responsible organizations. *Fortune* magazine after quizzing all trailer manufacturers, and nearly everyone qualified to speak on the subject, concluded that the trailer would cause a minor revolution in camping life during popular vacation periods, but due to its inherent impermanence and the unsanitary conditions that would accompany prolonged trailer habitation, this vehicular gadget would never cause any lasting distortion of values—either real estate or social.

It cannot be doubted, however, that the trailer has made its presence felt in many branches of the national life and that the efficacy of its use in several instances will undoubtedly contrive to make it henceforth an increasingly familiar sight. The traveling salesmen, especially those engaged in demonstrating a more or less bulky commodity, have found the trailer a most valuable trade stimulant. Their companies buy trailer shells (trailers without standard interior) which are fitted out as demonstration rooms for, say, various electrical appliances. Circus folk and itinerant stock companies have discovered in the trailer a cost-cutting convenience that is alleged to have caused a minor boom in their respective professions, and sparsely populated districts have been visited by traveling lending libraries built into trailers.

Most startling, perhaps, of all the many unprecedented uses of this odd automobile appendage, is the impressment of the trailer into the field of religious teaching. Under the provocative heading of "Gospel by Gas" the *Literary Digest* recently reported the case of a Catholic priest who took up his abode in a trailer and spread the gospel throughout impoverished sections of Southern Alabama. The apostolic trailer was equipped with altar, pulpit, confessional, and it was hoped that a portable hymn-playing phonograph would soon be added to complete the churchly illusion.

It was for purely practical purposes that Curator Anthony and his associates decided to experiment with the trailer as a vehicle for field collecting. They branded as quite without foundation your Explorer's suggestion that their proposed emulation of the Alabama priest's technique would mark the beginning of another chapter in the ancient feud between religion and science. Doctor Anthony feels that the two phenomena are simply indicative of the degree to which technical progress, the sauce of modern industry, is proving both palatable and beneficial to the more austere human activities. He maintains that every possible mechanical improvement should be added to the equipment of a phase of Museum endeavor which is so vitally important in furthering the horizons of scientific knowledge.

No commercial prototype of the modern "covered wagon" will be more elaborately tricked out than the mammalogy trailer. Last March a 21-foot Pierce-Arrow trailer-shell was purchased and taken to the extensive Museum carpentry shop to be transformed into a scientific laboratory on wheels. When it makes its maiden voyage, scheduled for the first week in June, it will contain among other things, an electric refrigerator, a stove, radio, formalin-filled tanks, facilities for skinning animals and racks where the skins can be hung to dry. There will be a generator capable of producing current of 32 volts which in addition to supplying the lighting, heating and refrigeration units, will operate the pumping system attached to three drinking water tanks capable of holding 25 gallons each. Then there will be several built-in cabinets for storing specimens together with the regulation army locker trunks containing storage trays. So compactly has all this been arranged that there will still be room for the sleeping quarters of four people. The trailer will be drawn by a Ford station wagon equipped with heavy transmission and differential giving it more hauling power. In addition to pulling the trailer, the station wagon will carry overflow equipment.

By using the trailer, Doctor Anthony believes that a multitude of bothersome camping details can be eliminated. Trailer mammalogists will always have a plentiful source of water, a common, but most important item on all expeditions, and will be provided with both entertainment and a means of communication via a short and long wave radio. They will have drastically cut down the possibility of losing valuable specimens through disintegration because of the ice box, and they will be enabled not only to make larger collections with safety, but to cover far greater ranges and carry particularly perishable collections to railroads for immediate shipment back to the Museum.

The trailer, contingent on the success of its operations this summer, is intended for use throughout the year. Plans are afoot to visit those states which retain favorable climatic conditions during winter months. The initial expeditionary trip will probably be confined to Arizona, New Mexico, and the Southern part of California. In these regions it is hoped that the Museum's collection of North American mammals will be greatly expanded. Emphasis will be placed by the collectors on the smaller animals, but their wealth of equipment permits the taking of larger specimens should they meet with any types of scientific significance. Rabbits, gophers, prairie-dogs, kangaroo rats and mice, together with many different species of tree squirrels and ground squirrels are some of the catches they hope to bring back to the Museum for purposes of laboratory study and description. As soon as a collection becomes inconveniently large, it will be shipped from the camp to the Museum directly.

There is reason to believe that the trailer will

take its place alongside modern trapping methods as one of the greatest mechanical aids to the collecting division of Natural Science. It is not improbable that the trailer will lend an impetus and an acceleration to collection work which will result in the marked increase of scientific data in the very near future. The expeditionary unit of the future should have so enhanced its scope and mobility that, judged on the limited basis of numerical discoveries, the specimen collector may find himself in a position comparable to the modern track athlete, whose record breaking activities have been so greatly aided by mechanical improvements in athletic instruments and running surfaces. The expedition of the past was constructed on the unwieldy foundation of the base camp. Nearly all the supplies and equipment of the entire expedition had to be placed at a permanent base or depot from which point collecting parties set forth and could conduct their work only as long as their food, water, and portable mechanical apparatus held out. The trailer changes all that. It is itself, the base camp and can be kept constantly in a position only one jump behind the outermost collecting party. It eliminates much of the heavy tents, camp stoves and other paraphernalia which entailed the trouble and considerable expense of hiring pack horses and other vehicles for their transportation. Indeed, it is estimated that aside from the far greater technical facilities which it offers, the trailer will more than pay for itself not only as a time saver, and by the healthier, pleasanter, living conditions it provides, but on the actual dollar and cents basis of transportational costs per expedition.

As to the trailer's personnel during its maiden voyage, nothing is as yet definite. But in this respect it is possible that the trailer will usher in still another innovation in Museum expeditionary work. Doctor Anthony has long been interested in the idea of selecting young college biology or botany students, who are interested in gaining a practical knowledge of field technique, to supplement the more experienced operatives of his summer expeditions. He feels that such an arrangement would be to the mutual advantage of both the young men and the Museum. Heretofore various complications have prevented him from putting this plan into practice but he hopes that some such opportunity will be available this summer in connection with the mammalogy trailer.

RECENTLY ELECTED MEMBERS

THE following 409 persons have been elected to membership in the American Museum of Natural History since the last issue of NATURAL HISTORY.

Sustaining Member

Mr. J. C. Penney.

Annual Members

Mesdames William L. Austin, Jr., Henry G. Davis, Power Drum, David Lindsay Gillespie, M. E. Goodrich, Waldine Z. Kopperl, Richard Lewisohn, Helen B. Norton, R. P. Palmer, Dabney E. Petty, Leon Weil.

Misses Emily L. Braman, Dorothea Jung, Katherine Connelly Wisely.

Captain Harold E. Weeks.

Doctors George B. Bader, Lot Duncan Howard, Jr., Stephen Andrew Mahoney, Henry Milch.

Messrs. Herbert F. Barnard, Donald F. Bush, John A. Cousens, George Einstein, Stanleigh P. Friedman, I. E. Gray, W. S. Hoskins, Richard C. Hunt, Wm. Kohn, L. Parker McKinley, John R. Montgomery, Roy Pier, Edmund A. Prentis, Paul L. Rittenhouse, Arthur Eugene Sanford, E. J. B. Schubring, Walter H. Whiton, Earl B. Wilson.

Associate Members

Mesdames A. L. Bailey, Ira Leo Bamberger, Nelson S. Bartlett, Minnie N. Boe, John Wendell Brooks, Ida F. Catton, Charles R. Codman, J. F. Collerd, C. C. Cooke, Jane Carew Cotton, E. L. Grondahl, L. P. Dudley, Peter S. Duryee, Mildred B. Fox, Samuel Friedman, George Gottlieb, George A. Graham, Jr., Philip H. Gray, J. Amory Haskell, Otto Hensel, Belle Hoffman, Massey Holmes, O. R. Ihling, Joseph Johanson, A. H. Kahler, Nina B. Keller, Herman M. Kurtz, Sam Lee, Charles C. Lund, W. E. McClintock, Louise K. Mitchell, Anson D. Morse, M. Hubert O'Brien, Hamilton Osgood, Margaret Watson Perry, Ottavio Prochet, Edward S. Robinson, E. M. Runne, Leslie Rutherford, W. H. Sallmon, W. J. Sampson, Marguerita Sylva, William Tapley, David Terry, Hugh L. Thompson, Michael Wallach, Chas. H. Watson.

Misses Laura B. Ammerman, Barbara Barrow, Veda Baverstock, Helen B. Brown, Karla Kelsey Burdell, Frances D. Burns, Florence E. Cave, Betty Ann Chamberlain, Frances Colbourne, Anita M. Coogan, Elizabeth Cutler, Dorothy Decker, Josephine Drewisch, Florence E. Easterly, Etta Louise Elberg, Erith Frey, Ruth Galpin, Fannie Glasel, Kathryn R. Gutwald, Alice H.

Heinau, Ellen D. Hilles, Evelyn Hoke, Pauline M. Holtz, Vera Hormann, Mabel L. Howorth, Fern Huismann, Jemima Huppi, Mary E. Lester, Olive R. McClure, Merle Isobel McKelvey, Ottilie Merz, Edna C. Nefroney, Bertha A. Olsen, Phebe F. Perry, Martha E. Quick, Catherine Sheridan, Sue L. Smith, Matilda M. Speik, Elisabeth Stephenson, Faith M. Sturtevant, Dena D. Ungemach, Pauline Walsh, Ethel Webster, Nellie M. Weeks, Marie Leslie Weil, Emma E. Whaley, Emma A. Wolfe, Priscilla R. Wright.

Bishop R. C. Lawson.

Reverends Walter J. Atkinson, Hessel Bouma, Leo M. Cox, David R. Evans, J. E. Feldmann, Edward W. Fuhrmann, Clair Boyd Gahagen, Charles L. Gomph, Lewis A. Hayes, Louis Hlobil, J. Clarence Jones, John T. Jordan, James F. Kelly, Edward F. Kirk, Alexander J. McCabe, Coleman Nevils, S.J., W. S. Ratigan, John Rausch, Joseph A. Schreiner, Richard J. Stewart, Edward A. Tetrault, Matthias A. Thimmes, Frederick E. Tilly, M. Arthur Workman.

Brother H. Charles, F. S. C.

His Excellency Gen. Eleazar Lopez Contreras.

Colonel W. W. Brown.

Flight Lieutenant Albert Carter.

Captains Edwin B. Kearns, U. S. A., A. O. Kittell.

Commanders R. S. Galloway, Henry Mullinnix.

Doctors Sidney S. Berkowitz, Smiley Blanton, Nathan Blaustein, Ralph H. Boots, Philip King Brown, Thos. H. Cherry, J. Payson Clark, Paul Cohen, Natale Colosi, Frank C. Combes, Russell T. Congdon, John R. Cunningham, Ralph A. Eckhardt, Edward P. Eglee, Frank Embery, Charles J. Fish, A. O. Foster, Arthur William Friend, Jacob Gerber, Nathan Ginsburg, Martin Goldwasser, R. N. Guerra, J. Norman Henry, Irvin L. Hunt, Jr., Warren P. Kortright, Frank McCutchan, S. H. McFarlane, J. L. Manasses, Oliver F. Mershon, Hugo E. Meyer, Warren King Moorehead, Wayland A. Morrison, John H. Mulholland, George P. Pitkin, L. B. Reed, Max Scheer, Samuel Whitehouse.

Dean A. Roger Kratz.

Professors S. C. Dellinger, George N. Quam, Charles J. Robinson, A. M. Sattre, G. Tregonboff.

Honorable Alfred E. Smith.

Messrs. A. S. Albrecht, Richard S. Aldrich, Alexander Ferguson Anderson, J. J. Anzalone, Alexander Apisdorf, Billy Bacle, J. Hallet Badger, L. E. Bailey, Perry C. Baird, Jr., Frank C. Battey, Stanley D. Beard, L. A. Bechtol, G. A. Benton, B. A. Berthelsen, Marshall B. Bishop, H. R. Bissell, George A. Bond, Charles Bowman, H. H. Braucher, W. C. Brennan, H. Storrs Brigham, Jr., Samuel R. Bristol, Frank W. Buckner, C. Sanford Bull, Bob Burton, Edgar A. Clark, Walton F. Clarke, Joshua Clayton, Peter J. M. Clute, Edward Melville Coleman, George William Colton, Allen W. Conner, Eugene V. Connett, Paul E. Connor, John W. Cook, J. Robie Cove, M. H. Crissey, Harry E. Crump, Malcolm Davis, J. Louis Dawson, J. F. Dengel, C. E. Dewey, Martin J. Dietz, L. A. Doan, Thomas B. Eastland, John H. Edmonson, Jr., W. T. Eddy, Richard F. Einstein, Roland H. Ellis, Jr., Robert F. Evans, John H. Farnsworth, D. Feinson, Harry Eugene Fink, R. C. Fisher, Bernard Flexner, G. B. Flood, Frederick Foster, Marvin L. Frederick, Robert Paul Fried, Robert Frothingham, Frank K. Galgan, Paul L. Ginter, Leon Goodman, R. E. Greenwood, Joseph C. Grosjean, William George Haag, Claude Hamilton, Stephen T. Harding, J. Edward Hargraves, J. C. Harris, John P. Hart, Frederick Hartney, John G. Haulenbeek, Bob Hay, Paul R. Heygel, S. W. Hines, Chas. D. Hodgman, George J. Holden, William F. Hollenbeck, Jr., O. L. Hollister, Jonah H. Honig, V. O. Hooyer, Chas. F. Hottes, Frank R. Howells, James P. Hudson, Daniel E. Huger, J. Harvey Hurd, L. S. Inscoe, Karl Isakson, Charles L. Jackman, Percival E. Jackson, William R. Jackson, Smith Johnson, Harry B. Jordan, Charles H. Judson, John C. Karshner, W. V. Kellen, Herbert H. Kimball, C. A. Kirstein, Charles David Kreps, Walter E. Kuenstler, David W. Lane, Robert E. Lawrie, Edward Colston Leigh, W. R. Lenderking, Edward I. Levy, John Fulton Lewis, Charles Liedl, Edmond E. Lincoln, Louis M. Loeb, Alfred A. Look, J. Norman Lynd, Charles Bennett Marr, Eduard T. Massey, William McAdoo, Chas. A. McDonough, W. J. Marsh, Emlen Linton Martin, J. Truitt Martin, Robert Curtice McCain, John Macarthur McLean, Hugo L. Menke, William Merkel, Tobias Miller, W. B. Minturn, Lawrence G. Mitchell, Lawrence R. Moran, Norman Morgan, W. A. Morton, William Morton, Adolf Muller, David M. Myers, J. L. Neuscheller, Edwin V. Noble, F. J. Oakes, Jr., Leon Pulaski O'Hara, Thomas A. O'Neill, Chas. C. Orcutt, Bill Ortel, Robert William Ostrow, Sam Papas, Jacob Patent, C. A. Pennell, W. R. Peterson, Norman Pflomm, Waite Phillips, C. W. Pimper, Ralph H. Poole, Jr., Harry H. Purdy, W. N. Queal, C. W. Quinn, Roderick Reid, Ed Rejda, Charles A. Reynolds, George H. Riley, A. W. Robertson, C. J. Rosebault, Louis Rubin, Henry Sampson, Jr., Max Schiller, B. E. Schlesinger, Charles L. Schultz, Elwood A. Seaman, Theo. Seelmann, Toscha Seidel, S. M. Semple, Robert G. G. Sessler, B Philip Sheridan, James E. Shields, Arthur R. Smith, Wm. F. Stembler, Tobias Stern, Edward G. Steinmetz, Justin Sturm, L. A. Summers, Douglass D. Sweetser, H. A. Thornton, Robert Green Tolman, Joseph L. Tressel, F. P. Underwood, E. Gavalda Valenti, Frederick P. Van Tine, W. W. Waddell, E. C. Waldvogel, R. W. Watkin, Samuel C. Webster, Jr., Alfred J. Weisbecker, Tom Welton, Clarence F. Wessel, Parker W. Whittemore, Westmore Willcox, Jr., David Wise, Vic E. Wood, Clement L. Yaeger, Willard H. York, Fred H. Young.

YOUR NEW BOOKS—*The story of Richard Burton—Big-Game Fishing—Penitente Ritual—Men of Mathematics—Idaho—American Physiography—Roaming in Hawaii—Wilderness Wanderers*

BURTON OF ARABIA. THE LIFE STORY OF SIR RICHARD FRANCIS BURTON

- - - - - - - - by Seton Dearden

Robert M. McBride & Co., $3.00

OCCASIONALLY, stodgy, repressed English society produces an eccentric genius and is thereby amazed, annoyed, and intrigued, like a hen who has mothered a duckling. In our own day Lawrence of Arabia was such a man and so in the Victorian era was Richard Burton, who also earned the appellation "of Arabia." The resemblance between these two men is striking: both were irresistibly drawn from the soft, green fields of England to harshly lit eastern deserts, both preferred life with the bedouins to western society, both were scholars of the first rank in their own and in alien languages, and both were destroyed by conservative officialdom which could not understand them and with which they would not compromise.

It is perhaps a triumph of restraint that the author of this biography of Burton barely hints at this curious parallel, or he may have been more impressed by the great differences between the two men or anxious not to offend worshipers of the nearer hero. The facts are that Burton's work has incomparably more permanent value for the world.

Burton's name is still familiar to all as translator of the Arabian Nights and as author of notes on Arabian life which the prurient expurgate and at which the obscene snicker. Few remember that he discovered the East African lakes, opened the way to the sources of the Nile, and penetrated into forbidden Mecca and Harar. Probably only scholars now realize the essential part that he played in opening some of the darkest regions of the earth and in advancing the serious study of many aspects of oriental life and literature.

Burton's career began in India before the mutiny as an officer under the East India Company and it almost ended there prematurely, partly from illness but mostly from the beginning of his innumerable and inevitable clashes with authority and public opinion. An invalid at home and in bad odor with his associates, he threw himself into the first major adventure, the journey to Mecca in disguise.

We often say of a linguist that he speaks like a native, but this is very seldom true. In Burton's case a faulty accent would often have been a death warrant and the fact that he completed his whole daring plan testifies better than words to his almost unequaled linguistic attainments. He was fluent in some twenty languages and in several was as much at home as in English.

The pilgrimage to Mecca was followed by a dash to equally forbidden Harar in Abyssinia and later by the less romantic but equally difficult and more important discovery of Tanganyika. These three episodes occupy about two-thirds of the book. Burton's later life, thus condensed to make room for more sensational matter, took him to Salt Lake City in the vain hope of studying polygamy (of which he approved), to Fernando Po, whence he made a journey to Dahomé so picturesque that the biographer again gives details, and then to Santos in Brazil. He had given up earlier hopes of returning to India and had entered the consular service, for which he had eminent intellectual qualifications and complete temperamental disqualifications.

Transferred to Damascus, evidently the ideal post for him, it was not long before he was ignominiously recalled. It is doubtless true, as Mr. Dearden says, that this failure was caused by infamous intrigues against him, and yet it is evident that had it not been one cause it would eventually have been another. Burton and the Foreign Office were simply mismated and could never have been compatible. It was this same bewildered, indignant officialdom that gave him a final sinecure at Trieste where he was able to carry on his researches for years and where he died in 1890 in his seventieth year.

Through this career, the protean qualities of which cannot be suggested in a review, runs the no less remarkable story of courtship and marriage. Burton's wife, born Isabel Arundell, was a Victorian Englishwoman and a devout, superstitious Roman Catholic, with everything implied by these terms, including the capacity for unswerving, passionate devotion which she lavished on Burton. He was an anti-conventional, quarrelsome, amoral, atheistic amateur of the erotic with leanings toward mystic Mohammedanism. Isabel disapproved of him with her whole mind and loved him with her whole heart; his feelings toward her can hardly be guessed from Mr. Dearden's book. On the whole the marriage was an unusual success, an achievement for which scant credit has been given to either.

Mr. Dearden states in his foreword that he is not competent to assess Burton's life and works accurately and in detail. He does not place the subject in any new light, nor does he achieve comprehension of a man almost incomprehensible. He gives little insight into the values, background, and meaning of this great career. His biography is not scholarly or interpretive but is a good job of reporting, conveying in journalistic fashion such highlights as have most popular appeal. It is unfortunate that the aim is so limited, but this aim is admirably achieved. Even though the appeal is purely popular, most readers will regret the absence of a bibliography.

G. G. SIMPSON.

PHYSIOGRAPHY OF THE UNITED STATES

- - - - - - - - by Frederic B. Loomis

Doubleday, Doran, $2.75

THOSE who are interested in a rather non-technical yet scientific explanation of the varied landscape of the United States, will find Professor Loomis' book the most up-to-date complete treatment of the subject. Moreover the treatment is unique. The first one hundred pages, which constitute Part I, are devoted to a rather concise and especially clear discussion of the more salient processes that build and sculpture plains, plateaus, and mountains. In the second and final part, the reader is introduced to the Atlantic and Pacific shore lines, and is then taken to the glacial coast of Maine, through New England, and south along the coast and the Appalachians; west across the Great plains to the Black Hills and the Rocky Mountains; over the Grand Canyon to the Basin Range country from Death Valley to the Grand Coulee; westward to Crater Lake and the Cascades; and down the Pacific coast to California. From Coney Island to the Rancho la Brea tar pits of Los Angeles, every outstanding physiographic feature is studied.

In some instances the treatment seems all too brief but briefness is always accompanied by conciseness, and the author never fails to give ample references to fuller treatments of the particular province under consideration. Over two hundred drawings, diagrams, maps, and photographs illustrate the text, and the large, yet not cumbersome, U. S. Geological Survey map showing the physical divisions of the United States is inserted.

The book is intended primarily for the undergraduate student, and in this it is preeminently successful. It might equally well have been intended for the tourist—not the kind who is interested mainly in how many miles he can drive in a day—but for the traveler who wishes seriously to inquire into the history of such natural occurrences as the Carlsbad Cavern, the Grand Canyon, the Great Salt Lake Desert, or Old Faithful.

ERICH M. SCHLAIKJER.

SALT WATER FISHING

- - - - - - - - by Van Campen Heilner

The Penn Publishing Company, $5.00

PUBLISHERS' "blurbs" on book-jackets are not usually over modest in setting forth the claims of their books upon the attention of prospective buyers; but the advertising copy for *Salt Water Fishing*, even in its heaped up superlatives, falls short in its attempt to suggest the vitality and sustained interest of the book itself; which is not only a catalogue of fishes, fishermen and fishing gear but a gorgeous Arabian Nights entertainment. Before giving us the details as to where to go and what to take along as tackle and bait for the pursuit of any of his very much alive prizes, the author takes us with him on one or more of the thousand and one days or nights of his own adventurous but not in the least checkered career as a knight of the reel and rod.

A sort of piscine knight errantry is evidently the unconscious aim of "Van's" fraternity who are, one and all, motivated by the "necessity of doing things for fun," as one of his friends very happily phrased it. Whether on foot, casting out from the beach for "stripers" (striped bass) or riding the plunging *Punkinseed* in pursuit of these wily foes; this is the urge and drive which prompts these debonair sportsmen to gamble their lives on the skill and team work of the "maestro" Otto Scheer and his captain Bill Bassett. And when the battle is over, it's hats off to the gallant fish that put up such a noble fight before giving up the ghost.

Thus the "parfait gentil knight" is ever ready to pay tribute, not only to the foe, but to his teachers, brothers and rivals in fish-chivalry, if we may be permitted to coin such a hybrid word. Only once in the whole book, so far as the reviewer can discover, does the author permit himself a cryptically worded, but unmistakably disapproving gesture toward certain unnamed alleged fishermen ("fish hogs" the late Doctor Hornaday would have called them) who have at times shaken his faith in humanity. His book is made up of one joyous chapter after another —each singing the praises of the chase. Take this for instance:

"The largest marlin I ever saw was off Bimini in 1928. We had left Miami about one o'clock in the afternoon and as we got nearer the Bahamian side the sea flattened out like a lake. As we neared the land we thought we'd put out a couple of lines and maybe pick up a kingfish for supper. The tops of the palms and the clump of pines at my home on Paradise Point were just above the horizon when I saw a huge form following my bait. But whatever it was wouldn't take it. I dropped back to him and then reeled rapidly in. He rushed in pursuit and when about twenty feet from the stern of the boat, turned broadside without taking the bait. We were all standing up and got a wonderful view of him in the crystal clear water of the stream. He was the most gigantic thing that any of us had ever seen. He must have been at least fifteen feet long and weighed well over a thousand pounds. His big round eye glared up at us like the eye of some huge prehistoric monster. We were all so frightened we could hardly speak. We made two or three circles back over the spot but couldn't raise him again. Probably it was just as well as had we hooked him we would have messed around out there all night. I believe the biggest marlin in those waters are further offshore than is generally supposed."

In conclusion the reviewer may perhaps express the regret that this superb portrait gallery of fish notables should be almost without benefit of fish genealogy. Would not such ardent and genuine naturalists as the author of *Salt Water Fishing* care to learn, for example, that from a genealogical viewpoint a wahoo may be considered to be an elongate mackerel and a sailfish only a gigantic wahoo with greatly produced snout and a dorsal fin grown monstrous? Many such ideas are set forth in the neglected systematic section of this Museum's Hall of the World of Fishes. But those who throng that Valhalla of the Big Game Fishes at the other end of the hall have for the most part, never had the opportunity of hearing that the deciphering of the Evolution of Fishes by means of the sciences of embryology, comparative anatomy and palaeontology is a very lively and fascinating subject. At any rate *Salt Water Fishing* makes real personages of many fish species. Perhaps the next step will be the arousing of more general interest in their classification, past history and origin.

W. K. G.

BROTHERS OF LIGHT

- - - - - - - - by Alice Corbin Henderson

Harcourt, Brace, $2.50

WHILE reading *Brothers of Light*, one fairly breathes the atmosphere of New Mexico. The author has pictured life along the Rio Grande so perfectly that the noises of city streets are shut away and the reader is transported afar off. Skies are vast reaches of blue, warm sun shines on the piñon trees. Time stands still and we are in the Middle Ages, far back in some native village. Life moves slowly and the years bring few changes to those who remained after the Spanish conquest in a new land far from home. Here a feeling of ageless time prevails—and more so during Easter than at any other time of the year.

Mrs. Henderson's descriptions of the drama of the crucifixion of Christ as re-enacted by the Penitente Brotherhood each year are accurate and the result of close observation, thoughtful study and much research. Hers is a sympathetic understanding of a people usually looked upon as ignorant wood-haulers by Americans who fail to find the slightest shred of romance in the lean, much weathered faces of the descendants of Spanish Dons.

The day is rapidly approaching when it will become almost impossible to watch the Penitente Processions moving slowly over the hillsides. The brothers are fighting hard to preserve the ancient rites of the third order of St. Francis from twentieth century invasion. Mrs. Henderson has lost none of the thrilling weirdness in telling of that hour spent in utter blackness praying for the souls in purgatory.

For those who have heard chants coming out of the distance on white moonlit nights, the collection of translated hymns used by the brothers are most interesting. With the inclusion of this collection in her little book, Mrs. Henderson proves her sincerity in writing *Brothers of Light*. The translation from Spanish into English is good. However, as is always the case with translations, shades of meaning are sometimes lost.

The book will have a tremendous appeal for all who search for information on historical religious orders and their rites. Tourists who catch at murmurs of death carts, crucifixions and flagellations in their hasty dash to see everything in a new country full of Indians and cowboys will more than welcome this little book so easily read, with its charming pen and ink sketches by William Penhallow Henderson.

MRS. CAROL MONTOYA.

MEN OF MATHEMATICS

- - - - - - - - by E. T. Bell

Simon and Schuster, $5.00

IN this book of 29 chapters are the biographies of most of the great mathematicians who have done outstanding work. The book is not a history of mathematics, but each chapter tells of the life of one or more of these men of genius, and includes an outline of that particular phase of mathematics developed. This is an excellent method, for it shows how the foundations of the science were made.

The reader who is familiar with college mathematics can follow the abstract mathematics quite well by some application. However the arrangement is such that any reader can skip the technical outlines without harm to the story of these great men. Nor is it necessary to be much interested in mathematics to enjoy the book. The book is absorbingly interesting; for anyone interested in general science it is positively *inspiring*. It is the kind of book that holds its reader far into the night. As in other good biographies, there is not a little space devoted to the habits of the men and their methods of thinking, and to their prodigious mental capacities.

Doctor Bell mentions the fact that the greatest mathematicians of all history are Archimedes, Newton, and Gauss. Archimedes besides being the greatest intellect of ancient times was "modern to the core," for he possessed the "unfettered freedom" that the modern mathematicians allow themselves. A chapter covers Newton, and shows how he developed the calculus, the law of gravitation, the laws of motion, wrote the *Principia* and made many experiments in light. Over fifty pages are given to the life of Gauss. His extraordinary precocity as a child is related, together with subsequent mathematical developments. When the first asteroid, Ceres, was discovered, it was lost, and Gauss (then about twenty-three) invented a method of calculating the orbit, a difficult feat in mathematical astronomy.

Chapters are given to Descartes, who developed the analytic geometry, to Fermat, a pioneer in the theory of numbers, to Pascal, who instituted the theory of probability, to Leibnitz of calculus fame, to the several Bernoullis and the calculus of variations, to Euler, the most prolific mathematician, who wrote enough original papers to fill 60 to 80 large quarto volumes, and to Lagrange and Laplace, who worked on analysis and probability. Also are described the originator of the Fourier series, the Cauchy integrals, Riemannian surfaces, Hermitian forms, the Galois theory of equations, Abelian groups, and other technical processes used in higher mathematics. One of the best sections describes Poincaré, one of the greatest modern mathematicians, who did so much for celestial mechanics. "His mathematics was done in his head as he paced restlessly about," says Bell, "and was committed to paper only when all had been thought through. Talking or other noise never disturbed him while he was working. In later life he wrote his mathematical memoirs at one dash without looking back to see what he had written and limiting himself to but a very few erasures as he wrote." In conclusion, let it be said, that the author's style is very pleasing, and the book beautifully printed.

HUGH S. RICE.

WILDERNESS WANDERERS

- - - - - - - - by Wendell and Lucie Chapman

Charles Scribner & Sons, $3.75

THE growth of popular interest in hunting with the camera and conservation of wild life in North America has been universally aroused in recent years.

In their compact narrative, the Chapmans tell how they first ventured beyond the highways into the wilderness of the Rocky Mountains. It is an unusual story, skilfully recorded against a background of incomparable beauty. Their experiences, some exciting, some humorous, and all entertaining are related with the utmost fidelity to fact and without any attempt to fictionize the natural material. It is doubtful if a dramatized interpretation of the Chapmans' experiences could be more attractive. This book tells a very realistic story of both large and small animals encountered in the West. The wild animals seemed to realize the good will of the Chapmans. In some instances they made some unusual friends and thereby obtained detailed information on life histories, which is a welcome addition to our knowledge of American wild life. This volume has a complete index and is full of interest for those who like reading about camp life and the great out-of-doors. It tells of the perilous predicaments in which the authors found themselves in the rockies and dozens of other incidents that give an excellent portrayal of the American West and its native animals. One of the most attractive features of the volume is the splendid profusion of photographs taken by the Chapmans.

GEORGE GOODWIN.

IDAHO, A GUIDE IN WORD AND PICTURE

The Caxton Printers, Ltd., $3.00

MOST people must do their traveling by proxy. Idaho, being far from centers of population, is an unknown region to all but a few. Lacking national parks and glacier-capped mountains the State has not been exploited for tourist attraction. By publishing this compendium of information the WPA has conferred a useful service upon Idaho, directing attention not only to its history and resources but in conclusion to the many trips available to tourists in the State, logging off in detail the descriptions of places of interest along the routes. Fortunately the anonymous authors know how to write, for the descriptions of early Indian raids are compellingly realistic, and even the accounts of such prosaic subjects as flora, fauna and natural resources are presented with literary skill.

A strange regulation of the WPA requires anonymity for the volumes issued in the American Guide Series of State manuals. Though sponsored by the Secretary of State of Idaho, who officially holds the copyright, the volume here announced represents another's authorship and editorial supervision worthy of recognition.

Because Idaho is part of the Inland Empire it was not settled as early as the districts bordering on the coast. The first white men to reach Idaho were in the Lewis and Clark expedition who in 1805 crossed on their way to the Pacific. For fifty years thereafter only scattered groups of trappers occupied the State, with here and there a few missionaries to present the Catholic, Protestant and Mormon faiths to the Indians. From time to time militia were dispatched from the East, ostensibly to keep peace with the Indians, but actually serving to disposses the tribes of their homesteads.

The discovery of gold in 1860 brought miners by the thousands, built boom towns, and created new feuds with the pioneer cattlemen and with the natives. The Indian wars of 1870-1880 were followed by the completion of two transcontinental railways across Idaho and the rapid consequent development of agriculture. In 1890 the Territory became a State of the Union.

Idaho comprises 54 million acres, of which 39 per cent is in forest, mostly located in the mountainous northern panhandle of the State. Southern Idaho is open country, part of the expanse which early geographies called "The Great American Desert." Physiographically, geologically, biologically and sociologically northern and southern Idaho are distinct countries. Timber, minerals and waterpower abound to the North; farming, dairying and livestock raising characterize the southern portion. In large part the agricultural development of southern Idaho has been made possible by irrigation, whereby the desert sagebrush country has been converted into prosperous farms.

Miles of green alfalfa, the most nutritious of forage crops, vast fields of the famous Idaho potato and orchards of prize fruit have taken the place of uninhabited desert. Buffalo no longer roam the plains; the fenced grazing land now supports herds of beef cattle and multitudes of sheep. The Indian tepees have changed to populous cities. The old Wild West of frontier days has been subjugated. Visitors to Idaho meet people like themselves, who live in similar homes and towns and cities, who are proud of their schools and universities, and who are peacefully engaged in farming, business, mining and lumbering. The strikes and turmoil of manufacturing communities seem distant to Idahoans.

To read the book at home is to know and to understand Idaho. To those who come to Idaho before their journey's end this volume extends an invitation to tarry.

A. L. MELANDER.

MARINE GAME FISHES OF THE PACIFIC COAST

- - - - - - - - by Lionel A. Walford

University of California Press, $5.00

THIS book should be in the library of every sportsman angler who plies the warmer waters of the Pacific Coast of America, and is desirous of knowing the fishes he catches. According to the author most of the material for it "was gathered during a two months' cruise in Mexican waters in March and April, 1935, on board Major Max C. Fleischmann's Diesel yacht *Haida,*" and it is the southern game fishes found there that are treated in detail. The numerous sea-basses of these waters are gone into comprehensively, as well as the big mackerels, marlins, amberjacks and related forms which comprise their principal big-game fishes. There is also a chapter on Pacific salmons, and for persons whose interest in all fishes large or small has been aroused, a workable key by which the family of any salt water fish along the whole Pacific coastline may be determined. Considerable information about catching the various game fishes should be of practical usefulness, and the discussion of their habits, much of which is from first-hand observation, has natural history interest. The book is well written and readable, and though a reference rather than a literary production, is not without a certain glamour.

Reference books of this sort on fishes are frequently compiled from material that has been published and re-published with the addition of little that is new. There is a consequent tendency to leave old problems unsettled or untouched, and even, in some cases to perpetuate old errors. Such is noticeably not the case here. Recent studies of the fish themselves which the author has made or is cognizant of are principally considered, and it is this fact that makes the book a real contribution to our knowledge of the subject, even though every departure from standardized opinion is not sustained. The illustrations, most of which are new, in themselves form a significant contribution. They include color-plates of about sixty species of fishes, many by direct color photography, and some of great beauty.

J. T. N.

A BEAST BOOK FOR THE POCKET

- - - - - - - - by Edmund Sanders

Oxford University Press, New York, $3.00

ONE of a series of three pocket-size natural histories, this book describes, briefly and in non-technical language, the mammals, reptiles, and amphibians of the British Isles and surrounding seas. The author wrote the companion bird book, which has been well received by the public in Great Britain.

If the *Beast Book* were merely a series of descriptions of British animals it would have a limited interest to American readers. But a large section is devoted to a general account of mammals and their structure, in simple language and illustrated by diagrams. Many of the latter are cartoon-like, others show careful attention to detail. The author discusses feet, teeth, locomotion, and heredity in outline fashion, briefly and generally. The book is thus an introduction to popular mammalogy.

In addition to the wild mammals of Great Britain and Ireland, Mr. Sanders describes man, the chief breeds of domestic animals, and three introduced forms, now acclimatized, the gray squirrel, Sika deer, and muskrat.

There are colored figures of nearly every species and many domestic types, drawn to one of three scales. The colors of many of these plates are not true, due partly to the method of reproduction. Even so, in my opinion, they aid materially in identifying the species.

The style is telegraphic but clear and interesting. A lively wit brightens the descriptions, and the original manner of expression attracts attention. The avoidance of technical terms may be desirable in an attempt to popularize the study of mammals, but it may detract from the value of the book to students.

JOHN ERIC HILL.

ROAMING IN HAWAII

- - - - - - - - by Harry A. Franck

Frederick A. Stokes, $3.50

THE Hawaiian Islands have been an integral part of the United States for almost forty years, yet, says Mr. Franck, citizens on the mainland are still woefully misinformed on these Pacific islands. Mr. Franck cites the mainland correspondent who affixes a 5 instead of a 3-cent stamp on his letter and the common notion of Hawaii as a South Sea paradise where lovely, brown girls dance hulas on the slightest provocation. But one wonders whether this kind of misconception about Hawaii is any worse or more frequent than the erroneous ideas entertained by one section of the mainland about another.

At any rate, Mr. Franck has set out to draw a picture of the contemporary and varied life of the Hawaiian Islands as he actually found it, stripped of romantic overtones. He visited all the inhabited and some of the uninhabited islands in the group, explored the volcanoes, inspected the plantations, talked to members of the multifarious racial and social groups, observed the life and manners of cowboys, plantation workers, *haole* bosses and city dwellers, and dipped into vital as well as other statistics concerning the social and economic polity of the islands. The result is easy to read, informative, sometimes acute, occasionally prejudiced and always in the brisk, reportorial style familiar to his readers.

H. L. SHAPIRO.

THE ADVENTURES OF MR. RAMSHAW, THE EAGLE

- - - - - - - - by Captain C. W. R. Knight

Dodd, Mead & Company, $1.50

HERE is a true story, written especially for boys and girls, about Captain Knight's widely known and much traveled Golden Eagle, Mr. Ramshaw. The narrative begins with the hatching of the egg, in the spring of 1927, on a mountain crag in Scotland, and is carried down to the present time when Mr. Ramshaw is ten years old. Packed in this little volume are most of the stories that the author tells in his inimitable lecture on this same subject, but here told by the eagle himself, Mr. Ramshaw. The book is copiously illustrated from photographs and drawings by the author. And the illustrations, both photographs and drawings, are as appropriate in the book as they are in his lectures.

If there is a better naturalist-lecturer on the platform than Captain Knight, this reviewer has never heard him. His lectures are all illustrated by his own pictures, among which is a fine motion-picture record of the Golden Eagle. While Captain Knight is an expert photo-naturalist, he is an even better story-teller—a *raconteur par excellence!* His clever and amusing drawings, his motion pictures, his sense of humor, his understanding of dramatic values, together with his enthusiasm and zest, have made him a prince of entertainers.

In the book, the episodes include the capture of Mr. Ramshaw when a young eaglet; his days in the London Zoo; his going to live with Captain Knight; his christening by the daughter, Jean; his training in the ancient sport of falconry. There is a most amusing chapter on his escape when taking part in a historical pageant at Rochester in Kent England. Becoming tired and restless from so much noise, at the first opportunity Mr. Ramshaw soared away into the blue, while Captain Knight, in historical finery, gave chase as best he could. The book relates Mr. Ramshaw's first visit to America and also subsequent visits "when he disliked being treated as an undesirable alien" upon arrival here. He enjoyed his visit to the American Museum of Natural History, in fact was immensely pleased with all the adulation accorded him throughout America as he became better known. One day while sunning himself on the Hotel Gotham roof, he became interested in the Empire State Building so he broke his chain and went on an investigation tour of New York and its tallest building and finally landed in a police station.

We believe that the members of his many audiences will be grateful that this magnificent Golden Eagle has been preserved in a book.

CLYDE FISHER.

SCIENCE IN THE FIELD AND IN THE LABORATORY

—Eclipse Broadcasts—a Romantic Discovery—Ancient Cultures Unearthed—College Presidents Angell and Farrand Become Trustees

Eclipse to be Broadcast from Peru

Instant, on-the-spot reports of all the elaborate preparations for making scientific reports of the eclipse, the adventures of those striving to get the best possible view of the eclipse, and finally the great dramatic spectacle of the eclipse itself, are being broadcast direct from Peru by members of the Hayden Planetarium—Grace Eclipse Expedition of the American Museum of Natural History. Among the members of the Expedition are Dr. Clyde Fisher, Prof. William H. Barton, Jr., Miss Dorothy Bennett, and Mr. Hans Christian Adamson.

The remaining broadcasts of the series, which began in May, are as follows:

June 3rd—6:00 to 6:15 P.M., EDST: "Photographing the Eclipse from an airplane at an altitude of 30,000 feet."

June 7th—6:00 to 6:15 P.M., EDST: "Preview of last-minute preparations for scientifically observing the Eclipse."

June 8th—6:00 to 6:15 P.M., EDST: "First-hand report of the Eclipse itself—the greatest and most thrilling celestial show in 1200 years."

Transcripts of these broadcasts can be had by requesting them and sending return postage.

The earliest complete and authentic printed reports of the Eclipse will be sent from Peru to the American Museum of National History by fast plane and will appear in the July issue of the *Sky*.

The Romantic Discovery of the African Peacock

When Dr. James P. Chapin, of the Department of Birds, sailed for Belgium last July to continue his studies of African birds at the Musée du Congo Belge, he did not realize that his journey would lead him to the heart of Africa. There, in 1913, Chapin had "collected" from the hat of a native of the Ituri forest a wing-quill of an unknown bird. Fully labeled, he brought it home with him and, until recently, its identity had remained a mystery. The "discovery" of the species to which it belongs forms one of the romances of ornithology. Chapin described it as follows:

"In 1914 the Musée du Congo Belge acquired some sixty mounted birds from the small museum of the Compagnie du Kasai in the Rue de Naples, Brussels. Most of them had been collected before 1900, for about that time this small series of birds had once been loaned to the Musée du Congo, then located in the Chateau de Tervueren.

"Two of the birds bore a slight resemblance to peacocks and were already labeled *Pavo cristatus,* so when they reached the museum in Tervueren they were regarded as of no interest, and found a resting place on top of a cabinet in a room never entered by visiting ornithologists. They are known to have been mounted by De Rèze, a celebrated taxidermist of Brussels. Who first labeled them as peacocks, thus causing them to be lost to view for so many years, remains a mystery.

"There they stood in seclusion until early August, 1936. At that time I happened into the room, noticed the birds, and stood dumbfounded. One was largely rufous-brown with metallic green on the back, its secondaries boldly barred with blackish color. Here at last, I realized, was the bird from which my feather had come. Both birds had crests of a few narrow feathers, rising vertically. The second specimen looked mainly blackish, with violet and green reflections, and still bore a label: *Pavo cristatus, jeune, importé.* A large spur on each metatarsus proved, of course, that it was not young.

"Doctor Schouteden, Director of the Musée du Congo Belge, graciously permitted me to study these remarkable specimens, which he said I might describe if they proved to be of a new species."

A thorough study of their relationships confirmed the belief in their distinctness and Chapin has named this remarkable bird *Afropavo congensis.* Although it bears no close resemblance to a peacock it is more nearly related to that species than to any other living bird and as a common name Chapin, therefore, proposes African Peacock.

So great is the interest aroused by this surprising discovery that Chapin's friends in Belgium have raised a fund to enable him to return to Africa to search for *Afropavo* in life. On June 19, therefore, he expects to fly from Brussels to return to his former collecting grounds in the upper Congo.

Ancient Cultures Excavated in Chile

Two and one-half years of painstaking excavation in innumerable rock shelters, caves, and shell mounds along and near the coast of Chile, enabled Mr. and Mrs. Junius Bird to isolate two coastal and five land cultures which must have flourished long before the coming of the Spanish. They are all pre-pottery cultures in which no trace of the Spanish horse, iron, and trade beads were found. Some idea of the antiquity of the people whose cultural remains were unearthed is given by the fact that the earliest land cultures were discovered in positive association with the extinct sloth, and the New World horse. The latter had become extinct in the Americas and was an unknown animal until reintroduced by the Spanish. There were also traces of another animal, as yet unidentified, in the remnants of the two oldest land cultures.

In connection with the survey along the western coast of Chile, Mr. and Mrs. Bird who have recently returned to the Museum, had the opportunity of observing the little-known tribe of Alacaluf Indians who inhabit the islands from the Gulf of Peñas to the Straits of Magellan.

Part of their report consists of descriptions of the customs and industry of these simple fishing peoples.

Throughout their trip the Birds deeply appreciated the courtesy and cooperation of the Chilean officials and people. During the next year, Mr. Bird will prepare the detailed report on these important and extended excavations and explorations.

Two College Presidents Join Board of Trustees

Five new members were added to the Board of Trustees of the American Museum of Natural History at the spring meeting of the Board. The realm of education is represented by James Rowland Angell, President of Yale and Livingston Farrand, President of Cornell University; while the three remaining appointees, Mr. Lewis W. Douglas, Mr. Wilton Lloyd-Smith and Mr. Robert Earll McConnell, have distinguished themselves in public service, business and conservation. "The reason for increasing the number of Trustees at this time," said F. Trubee Davison, President of the Museum, "is that there is general feeling on the part of the Trustees that it would be wise to widen the scope of interest represented by the membership of the Board."

By enlisting the direct and active cooperation of such notable educators as Doctor Farrand and Doctor Angell, the Museum hopes to reach new heights as an educational factor.

"In recent years the educational activities of the Museum have grown by leaps and bounds," said Mr. Davison. "This is only proper since education is a primary function of the Museum. While figures are not always the best index, when it comes to evaluating educational activities, they do indicate the scope of the work. In that connection I am happy to say that statistics covering the Museum's educational efforts reveal that it made no less than 42,500,000 educational contacts in 1936, as against 39,175,000 in 1935. These impressive figures include lectures and classes for children and adults in Museum halls, in the Hayden Planetarium and in schools, as well as the total of students reached by circulating collections, motion picture films, and lantern slides. No better proof of the Museum's leading position as a popular medium for the dissemination of natural history knowledge can be found than the fact that the Museum attendance in 1936 reached the all-time high of 2,491,000 an increase of more than a quarter of a million over the preceding year."

Mr. Lewis W. Douglas, former Director of the United States Budget, has a distinguished record as a public servant. He will give to the Museum the benefit of his experience in public life and will aid in extending the influence of the Museum in wider fields of national service.

Mr. Wilton Lloyd-Smith and Mr. Robert Earll McConnell have both had notable experience in business, and in several fields of natural history. Their background and associations will be most helpful in the Museum's immediate program of development.

New Acquisitions

One hundred and forty-three specimens of the winter flounder—*Pseudopleuronectes americanus*—have been sent to the Museum through the courtesy of Mr. Robert A. Goffin, Superintendent of the Woods Hole Station of the U. S. Bureau of Fisheries. These form a fine series for Dr. E. W. Gudger's studies on ambicoloration in flatfishes and it is safe to say that no such complete series of teratological fishes of one species has ever been brought together in America.

Two-Headed Fish

Mr. Archie Thompson, foreman of the Yosemite Fish Hatchery, Yosemite California, has recently presented to the Museum three fine specimens of two-headed trouts for Doctor Gudger's study of such abnormalities. One of these is three and one-half inches long and is, with one exception, the largest two-headed bony fish ever recorded.

A Fish without a Tail

"The Ocean Sunfishes of the family Molidae are among the most highly specialized and yet most simplified of all fishes," said Mr. H. C. Raven, Museum Comparative Anatomist. While presenting a paper on the Anatomy of the Ocean Sunfish, *Masturus,* at the recent annual meeting of the American Society of Icthyologists and Herpetologists in Washington, Mr. Raven told of his findings during his recent dissection of both the ordinary and nipple tailed species of Ocean Sunfish. Among the peculiar phenomena which were disclosed are the following facts:

The Ocean Sunfish lacks entirely the ordinary metameric or axial musculature of typical fishes, that is, the set of muscles which causes the body to wriggle and forms the edible part of ordinary fish.

The muscles attached to the dorsal and anal fins, small in typical fishes are here greatly enlarged, filling most of the area primitively occupied by axial musculature.

Thus, the muscles of the dorsal and anal fins in the Ocean Sunfishes are the sole means of locomotion, the tail fin having entirely disappeared and a new substitute tail, which is merely a rudder, having been developed out of parts of the enlarged dorsal and anal fins.

The ocean Sunfish is related to the Trunkfish, whose specialized "defense mechanism" is adequately treated in this issue by Myron Gordon, and more closely to the Porcupine fish. The Ocean Sunfish, incidentally, is not at all related to the common fresh water sunfish.

Bird Study in Panama

During the winter the Department of Birds was represented on Barro Colorado, an island in the Panama Canal Zone midway between the Atlantic and the Pacific, by Dr. Frank M. Chapman and Mr. E. T. Gilliard. Aside from general studies of the avifauna of the island, the birds to which especial attention was devoted are the Massena Trogon, Ani, and Turkey Buzzard.

Under Sea Cannon Aids Geology

An account of the way in which the Carnegie Institution collected cross-sections of the ocean-bed under two thousand fathoms of water was one of the most spectacular communications addressed to the eighteenth annual meeting of the American Geophysical Union held in Washington, D. C., on April 28-30. The Museum was represented as heretofore by Dr. Robert Cushman Murphy.

The deep-sea cores of the North Atlantic were obtained by shooting a tensile steel tube from a mortar lowered to the bottom of the sea. Cannon and projectile are linked together by chains, and when the device is hoisted to the surface the tube is filled with a long core—sometimes ten feet in length—revealing the hitherto unknown sediments and underlying rock of the ocean basin.

Weber Venezuelan Expedition Returns

Mrs. Gladys Gordon Fry has only recently returned from the Peninsula of Paria, Venezuela, where she spent more than three months as leader of the Weber Venezuelan Expedition for studying and collecting the little known birds and mammals of this little explored and extremely wild region. The Peninsula, a mountainous ridge, juts into the Caribbean Sea not far from Trinidad.

Over three hundred skins of tropical birds were brought to New York, some of which will be placed at the disposal of the American Museum of Natural History.

Teaching Material Exhibit

In cooperation with Mr. Herbert S. Walsh, director of the WPA Educational Project, the Museum is exhibiting objective teaching materials and techniques, ranging from dolls' dresses to working models of the human eye and of steam engines. Various projects, inexpensively worked out by students of surveying, electricity, geology, industry, and other sciences cover a wide field of interests. The exhibit will run until June 4.

Another interesting exhibit planned for June 16 to July 5 in Education Hall is one of the activity work of school children attending city community centers.

Central Park Naturalists

Mrs. Gladys Gordon Fry, widely known as "The Bird Lady," opened her spring series of early morning bird and tree walks in Central Park on April 29. The walks, of which the last will be on June 10, have already attracted an unusually large attendance. Early on Thursday morning each week, students of ornithology and botany have made the rounds of the park under Mrs. Fry's able direction. As in former years, these classes have been conducted under the auspices of the American Museum of Natural History.

Eclipse Expedition

The Hayden Planetarium-Grace Line Eclipse Expedition completed its departure when Major A. W. Stevens sailed on May 21. Major Stevens is to photograph the total eclipse of the sun on June 8 from an aeroplane over Peru. Special tubes for the telescopes and portable darkrooms for photographic work were designed by the Planetarium technical staff. The expedition is equipped with timing apparatus which will make possible calculations of greater precision than ever before attempted by eclipse observers. This equipment, consisting of chronometers and second-setting watches is being furnished by the Longines-Wittnauer Watch Company and includes Longines chronometers which are the most precise time recording devices ever made.

Millionth Planetarium Visitor

On the evening of May 6, Mr. Ernest Dinsdorf, of Elmhurst, Long Island, stepped up to the ticket office of the Hayden Planetarium, and bought the millionth ticket to the "Theatre of the Stars." Mr. Dinsdorf was unaware of the various prizes which were soon to be his as the millionth visitor—a fine pair of Zeiss Binoculars, a Royal Portable Typewriter, and a three-day grand tour of New York as the guest of the Hotel Wellington.

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THE DRAGON OF THE LIAS EPSILON

(Continued from page 432)

veritable death valley under the seas. It is thought probable that a poison developed in the mud that covered the bottom, for example sulfide of hydrogen. Such mud, of course, did not offer shelter for hungry crabs, consequently the carcass of a larger animal was safe.

The shallow water of the bay may not have been poisonous all the time, so that it was not necessarily a dead sea. But when a storm broke or when a large school of ichthyosaurians, hunting a swarm of fishes or of fast swimming octopi, thundered into the bay, the thick layer of mud on the bottom was disturbed. The sulfide of hydrogen gas was released in large quantities and poisoned the water. And the animals succumbed to the poison, one after the other. Eventually the water was calm again, the mud settled, burying whatever had died from the poison: fish and fish lizards, plesiosaurs and ancient marine crocodiles, sea lilies and sharks.

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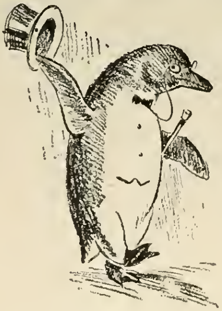

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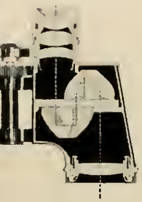

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Rainbow Room

THE TWILIGHT OF THE INDIAN PORPOISE HUNTERS

(Continued from page 416)

He said nothing for a few moments and then,

"I remember it like it was yesterday. I never thought I'd boil another porpoise. Them was great days, but they was hard days, too. Yes, boy, they was hard times. My uncle lost his life. He was out porpoisin' with a small boy and a shark come along and stuck his nose right through the bow of the canoe and tore a hole as big as that—" He made an "O" with his arms.

"—The old man was so scared he forgot himself and shot down on the shark through the canoe and she filled with water and turned over. The boy could swim a little and held on to the canoe, but the old man sank and never was seen alive again. The boy was picked up by other canoes and he never seen no more of the shark. On the next ebb tide we went lookin' for the old man and we found him in six foot of water just below where the bellhouse stands now in the Gap. I looked over the side and I seen him lyin' on the bottom and movin' this way and that in the water, all tangled up in kelpwood like a parcel. I dove down with a knife and cut him loose. It took a lot of wind, boy, goin' up and down so many times. I remember it like yesterday. That was forty-three years ago this October. Two years after that the machine oil come in and we didn't go porpoisin' no more."

Recent Museum Publications

NOVITATES

No. 916. Two New Bats, *Eptesicus* and *Mops*, from Angola. By John Eric Hill.
917. Studies of Peruvian Birds. No. XXV. Notes on the Genera *Thamnophilus*, *Thamnocharis*, *Gymnopithys* and *Ramphocaenus*. By John T. Zimmer.
918. Some Mineral Incrustations Selective upon Crystal Forms. By Clifford Frondel.
919. New American Lycosidae with Notes on Other Species. By W. J. Gertsch and H. K. Wallace.
920. Description of a New Species of *Symphylurinus* (Insecta, Dicellura) from Central America. By Filippo Silvestri.
921. Two New Harvest Mice from Honduras. By George G. Goodwin.
922. Results of the Archbold Expeditions. No. 15. A New Fish of the Genus *Bostrychus* from New Guinea. By J. T. Nichols.
923. Two New Tachinidae (Diptera) Parasitic on *Polybia* Species (Hymenoptera). By C. H. Curran.
924. Three New Species of *Tytthonyx* from Cuba. By Andrew J. Mutchler.
925. Two Reversed Partially Ambicolorate Halibuts: *Hippoglossus hippoglossus*. By E. W. Gudger and Frank F. Firth.
926. The Neotropical Species of *Melanostoma* and Allies (Syrphidae: Diptera). By C. H. Curran.
927. New Reptiles from the Eocene of South America. By George Gaylord Simpson.

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VOLUME XL—NO. 2 ★ ★ ★ ★ ★ **SEPTEMBER, 1937**

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From a drawing by Charles Curtis Hulling

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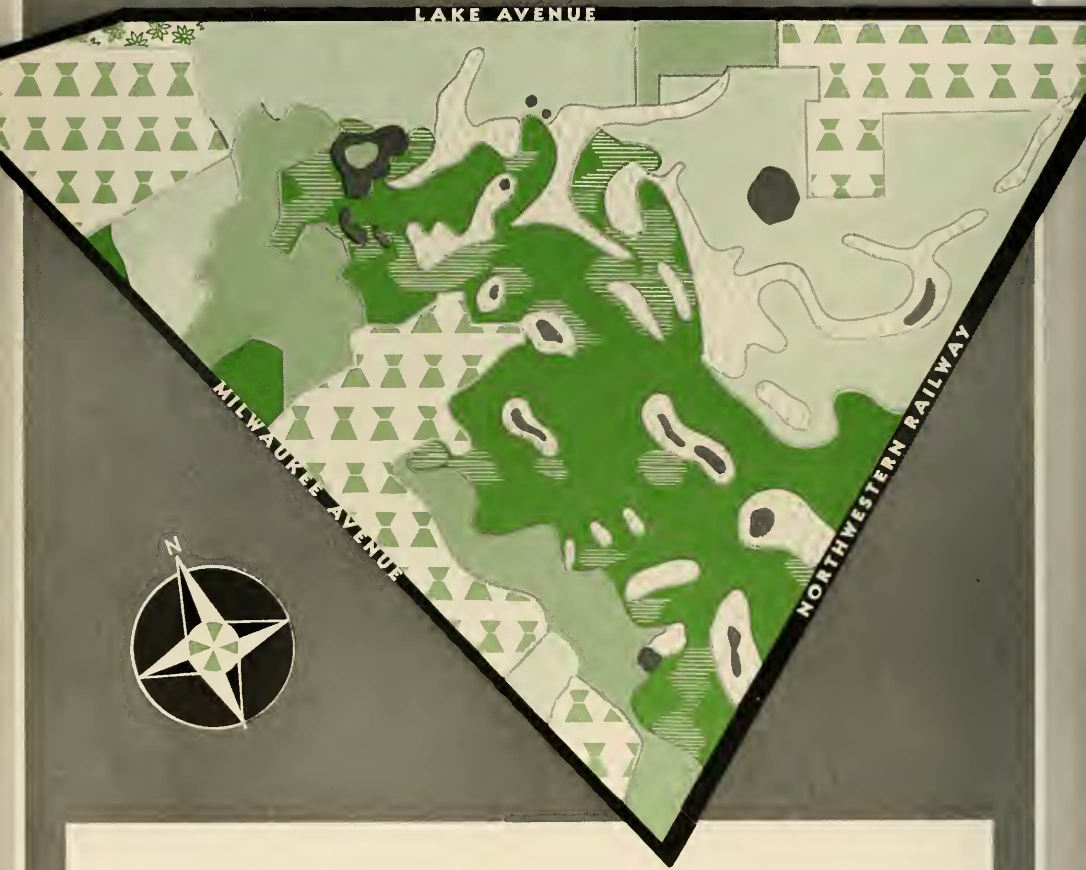
ONE SQUARE MILE!

Kennicott's Grove, Illinois



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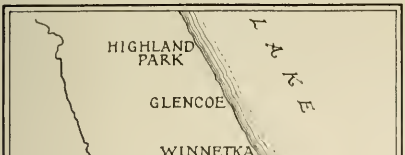
ONE SQUARE MILE—*Nature's intricate cycles in Kennicott's Grove, Illinois, reveal problems fully as enthralling as any the naturalist might meet at the ends of the earth*

By DONALD CULROSS PEATTIE

IT WAS twenty-four years ago that I first saw Kennicott's Grove from afar, its four-century-old burr oaks and its ancient shagbark hickories rising high above the watery green of the prairie in May. I hadn't then ever heard of Robert Kennicott (1836-1866), the foremost pioneer naturalist of Illinois, who was to die, at thirty, in Alaskan snows. I didn't know that he had already collected all the birds and mammals, the slough molluscs, and the wood salamanders of this, his boyhood home, and unearthed the runways of the field mice and the woodchuck's den.



I hadn't even heard of the romantic associations of the old prairie groves, those wooded islands risen on long low ridges out of the aboriginal grass sea. All of Illinois history is filled with the story of the groves. Indians and first settlers made straight for them, like the passerine birds on their migration. The island groves are to Illinois what hammocks are in the story of Florida. But they didn't teach history that way in my school, and I knew then little about natural history.

Introduction to the Grove

But before I saw it my best friend at school, Robert Kennicott's grand-nephew, had already made the spot sound legendary. He, too, knew all the birds, and had dragged the sloughs for their insects and snails and turtles. For my part (I was in my 'teens) I had at least a strong interest in botany, and a stronger interest in my friend's young sister, now my wife. So that every impression of that first visit is cut in crystal. Day-long the frogs chanted and the redwings gurgled and hovered over the sedge swamps. In the oaks, just hanging out catkins, the jeweled warblers drove through in a bewildering storm, so many kinds it seemed impossible one could ever learn any two of them apart. And, beyond the gardens, some of them now a century old, set out by the hands of Robert Kennicott's mother, shone the wild tangled lawns deep in the woods, secret dewy bog-spots where the shooting-stars, grown incredibly tall and lush, hung trembling and flaring on their fine stalks.

To those inner shrines of wildness one attained by fighting through a Sleeping-Beauty thorn forest of flat-topped, fierce-spined hawthorns, wild plums fuming with fragrant blossoms and crabapples decked out with great frail flowers. I remember encounters with the enormous ant hills, furiously defended, and the wood-wandering old snapping turtle, surly and powerful enough to inspire respect. And always, back of the flickers' cheery clatter or the tender contentment, endlessly reiterated, of the doves, ran the piping of the frogs, an upwelling, pervading antiphony that pursued one deep into the oak-openings carpeted pink with spring-beauty, or out on the windy prairie where the kildeer cried out as if in pain.

Those were first impressions, as much esthetic as scientific, and as it came about, I was to see many other sights and learn a little about the fauna and the flora of a number of places, before I found myself actually living at Kennicott's Grove. In the meantime I hadn't at any time supposed that, delightful as my personal associations with it were, this square mile of Illinois land was, biologically, worth much attention. After all, Robert Kennicott himself had left it, as he grew older, to travel ever more widely. And I took it as axiomatic that if one could possibly get to Nome or British Guiana or New Guinea, no naturalist would remain in Illinois.

A three-year vigil

But in the fullness of time, chance decided that Kennicott's Grove was precisely the place that I was to live in, there to remain without leaving it even for a night, for three years, winter and summer. Intimacy with this strictly parochial view of Nature opened my eyes to its beauty (and the charm of a prairie island grove is far less hackneyed a subject than many spots celebrated for declivitous or gracile scenery). But I learned also the value of knowing some one thing, at last, with a certain degree of thoroughness, be it only my one square mile. I even began to welcome the very limitations of my problem, as a sonnet writer his fourteen lines.

With the problem thus neatly delimited one may almost accomplish at times the ideal of every field naturalist, which is to allow not a flock of Lapland longspurs to escape him, not a waif weed to evade him in the ditches. Daily diaries make every detail a matter of dated record and of first-hand evidence that the faults of memory cannot damage.

First of all there is, for the parochial naturalist just as for him who roams a continent, the Adamite task of naming the beasts and the plants. If you are surveying a vast province, omissions are excusable. In a microcosm you must be able to call by its name everything that flies or runs or grows.* Then come maps; the locations of bogs, of conifers, of orchard trees, of cat-tail stands. These matter vitally when you begin to study the animals that affect those habitats.

So, after mere systematics comes ecology. One discovers that the low swampy woods, the elm-linden association of the botanists, is the green heron association of the birds. Exploring my ponds, I learned that there is an antipathy between cat-tails and bulrush (Scirpus) and that where they grow unlike sorts of birds will nest, and from their waters pipe different frogs.

Almost imperceptibly my notes began to yield up the details of what Emerson calls the punctual almanac of the birds. My Grove diaries tell the story of the great drought of 1934, of the rabbit cycles, of the mouse-year of 1935-6.

The mystery of the tree-girdlers

It was in 1935 that the whole neighborhood began complaining of the damage done to fruit trees and shade trees by some creature that was girdling the bark. Little teeth had sunk to the tender green cambium. Who was at fault, and what could be done about it? Squirrels, I knew, nibble the buds off the oaks in the great hunger of early spring. But I did not believe that even the ratty little gray squirrel, who has begun to invade the Grove again after many years of scarcity, and to dispute the trees with the beautiful big fox squirrel, would girdle trees. Porcupines girdle trees, high up, and one year there had actually been a porcupine (considerably out of his range), and there might be another. But these girdlings were too low for a "porky." They were even too low for a rabbit's toothwork, though, heaven knows, there are enough cottontails in our woods to kill all the trees in a season if they took it into their scatterbrained heads to work such mischief.

Two possible culprits remained on the short list of some twenty-eight Grove mammals (and, once again, how satisfactory it is to have your problems sharply delimited, almost classically concise!). The mole mouse is a notorious girdler of trees, but he dines upon the bark of the root. So that he was pretty well exonerated although I had to admit that I knew almost nothing about mole mice. So secretive are their ways, so cryptic their life habits, that even the owls, the most relentless mousers of the wood, seldom catch one to eat if one may judge by the contents of their pellets. Science cannot yet tell us the frequency of mole mouse breeding, and Kennicott gave no idea of their numbers right here in the Grove. In short, here was an animal about which less is known than about the African elephant, though it is a great deal more important to us.

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*Some will be curious to know the results of this qualitative survey. At the end of three years I had identified some 450 spontaneous flowering plants and (by no means less important) some 300 cultivated species. My catalogue of birds lists some 155 indubitable species with others still "to be expected." Of mammals my one square mile can boast only twenty-seven extant species with perhaps three more (the always mysterious bats). There are apparently twelve reptiles and of amphibians fourteen; the insect hordes are still unnumbered.

But alluring as the trail of the little mole mouse might look, the clues in the high crime (anthropomorphically speaking) of girdling trees led to the remaining suspect, the prairie meadow mouse.

And suddenly there were meadow mice everywhere. I met them on the road, and picked them up in my hands! As winter came on, the snow was crossed with endless mouse tracks, and tunneled with miles of white microtine subways. Hawks came, with the fall migration, and stayed all winter, breaking all previous records both for individual abundance and wealth of species. Never before had we seen so much of the owls—not merely our little screech owls, but the hoarse-voiced great horned owl, and the long-eared, who followed my electric torch about in the woods as if he craved society, mewing and yapping.

A challenge

And we began to find dead mice. To a naturalist a dead animal in the woods is always a challenge. Of what did he die? If he has a bullet wound it may mean that hunters are trespassing, and it is time to mend your fences, paint your posting signs afresh. Marks of a battle indicate fierce contests for survival with other creatures. Is the balance of Nature tilting? If there are no outward indications of death, has the mammal been poisoned? Did he die of starvation? Or have parasites or diseases begun to check a superabundance, a dangerous fertility? These questions it is the business of any woodsman or naturalist to answer. For animals, and plants, are not merely species which one may have fun in identifying. They are esthetically delightful, of course, but not merely that. They are living things with histories even now in the making. Dead, they are still biologically significant.

Living and dead, the meadow mice were thrust constantly on our attention that year. Going once into the basement at night, I was startled by a scrabbling sound on the window. I looked and for a moment saw a mere blur that whisked away into shadow. In a few moments the sound came again, and there was a meadow mouse with his forepaws on the pane, staring eagerly in. He had fallen down into the excavated embrasure of the basement window and could not escape. Gently I raised the window, and upon a blast of icy air (it was the terrifically cold January of 1936) the meadow mouse trotted inside, ran up and down, darted back into the snow and hid as if horrified at his boldness, and then peeped out again. My small boy fetched cheese, and I put a morsel of finest Parmesan on my finger. "Billy," as we called the meadow mouse, came forward and removed it ravenously—the tamest gesture upon the part of an utterly wild animal that I have ever seen. For three days Billy lived in the embrasure, making himself a nest under our eyes, giving us a chance to experiment with him by offering him various nesting materials, talking to us sometimes in a sort of terrified whisper. Then, unfortunately, in the twinkling of an eye, he had eaten a too-dead shrew that had also fallen into the embrasure. The meal did not agree with him. Billy went more or less mad, first exhibiting strange waltzing-mouse steps painful to witness and finally he died in a convulsion.

Billy's death under our eyes merely symbolized the beginning of the decline for meadow mice that year. The next spring, after the prairie had been burned off, I discovered that the summer nests of the meadow mice being compact and damper did not burn completely, and it was possible as never before to see every one. Also their little paw-beaten runways were revealed by the light swift fire in the dead grass.

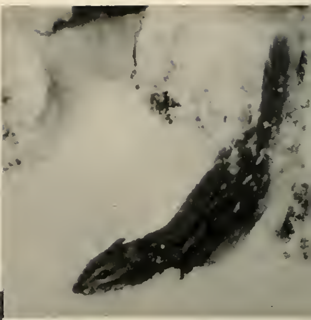
Census of tree-girdlers

So I counted every nest on an area which I measured and found to contain 3600 square feet. There were thirty-two nests on this quadrat. Each nest is said to be occupied by a pair of mice, each pair making but one nest. How many meadow mice had there been on my one square mile of land in the great mouse year? If all the land were suitable for mouse nests, that would give us half a million little tree-girdlers. But now my maps, so toilsomely made, and in such detail for every shading of ecological habitat, proved their worth. Potential meadow-mouse country was less than half the area. Even so that left us with a quarter of a million of these somehow likable little rascals. Allow for wide errors: say there were only a hundred thousand individuals on my one square mile. Even so, what wonder that our trees were girdled? That owls and hawks were never so plentiful?

The great mouse year came to an end, and many causes for our deliverance might have to be thanked for it. If, however, one is to predict the next recurrence of a mouse plague, one would have to understand the reasons for mouse booms as well as mouse depressions. (It had also, I should add, been a great year for deer mice.) It called upon to make a guess I should assign some of the following reasons for mouse years: A sudden falling off in mouse parasites.

. N. H. Photo

(Left) How much wood would a woodchuck chuck?



T. Gregory Photo
Courtesy: J. of

(Above) Chipmunks will empty nut-sack over-night

(Right) Cottontails we have always with us

T. Gregory Photo
Courtesy: J. of Mammalogy

THESE are the nibblers, the sappers and miners, the chisel-toothed. One of them was the criminal in the case of girdling trees. Pick your own suspect

T. Gregory Photo

(Above) Fox squirrels nip oak buds as well as nuts

(Below) Porcupines love the inner bark of trees

Photo by T. Gregory and R. S. Sturgis

A. M. N. H. Photo

(Above) Field mice will eat themselves to death

T. Gregory Photo
Courtesy: J. of

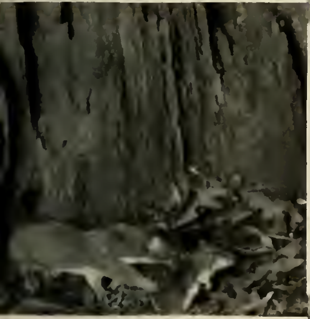
(Above) White-footed mous caught in flagrant delight

(Below) Gray squirrels are invading The Grove

T. Gr

T. Gregory Photo

(Right) Snapping turtles can bite off a finger



T. Gregory Photo
Courtesy: J. of Mammalogy

Above) Weasels are blood-thirsty nousers

Below) Racoons will fish, tree-valk or still-hunt

Photo by T. Gregory and R. S. Sturgis

(Left) The most-feared animal is the skunk

A. M. N. H. Photo

HERE are the hunters, who keep down the spawning hordes of the nibblers. Some eat insects, some birds, others reptiles or mammals. Attractive or repulsive, they keep Nature's balance

T. Gregory Photo

(Above) Short-tailed shrews have to eat every few minutes

A. M. N. H. Photo by Julian A. Di

(Above) When these baby herons grow they will hunt mice

A. M. N. H. P

(Above) Garter snakes keep down small vermin spawn

(Below) Red bats sweep twilight for insect pests

A. M. N. H. P

(But what controls *this* cycle I will not even guess!) And a diminishing in the numbers of their predators —weasels, shrikes, hawks, owls, herons, and others.

And finally, no doubt, there must have been a previous increase in the abundance of mouse food, which is largely vegetable. What causes mouse manna in a richer harvest of the little wild bulbs and tubers and corms of our native wildflowers, into which the hungry, keen rodent teeth sink so eagerly, which clever little paws roll into the subterranean chambers and horde? I found that I did not know. Probably freedom of the plants from *their* parasites was part of the answer. But of the billions of nematodes in the soil, of cryptic fungi, some harmful, some beneficial, of the bacteria without which life could not go on at all, I knew practically nothing.

A large square mile

If I had spent three years of continuous residence in the jungles of Malay, having as my main business nothing but observing nature, I would probably be able, upon emerging, to deceive myself and even others into thinking that I was a veteran if not an authority in Malaysian Nature. I have learned, however, that three years is utterly insufficient to make me a master of a reasonable amount of wood-wisdom concerning one square mile of Illinois land. My notes now run into the hundreds of pages, and tell me but a fraction of what I need to know. Even with the specimens and the writings of a great predecessor like Robert Kennicott, I am insufficiently equipped. But I see, at least, how the burr oaks and the chains of the haunting wood-sloughs, and the sweep of the prairie prospect, all nurtured Robert Kennicott the scientist, and how, after twenty years of learning what home could teach him, he was ready, at last, to go to the strange places of the earth.

True, Kennicott lived in an age that was, zoölogically, closer to unspoiled Eden than ours. No sandhill cranes ever nest in the Grove now, and the black tern never skims above our shrunken ponds. The passenger pigeon, the paraquets, of which he took specimens, are extinct, and gone are the deer that he must have seen. Time and change have, with a relentless blade, simply decapitated the top of the family tree of the animals. So that the captains and the kings are departed, the bison and elk and bear, the beaver and timber wolf and cougar. Today the most dreaded animal in these woods is the skunk, the bloodiest killer the weasel. Cattle have trampled down the white lady slippers, so that, locally, they are as extinct as the prairie chickens, and almost all of the aboriginal high-grass prairie, with its marvelous wild cereals and its exquisite flora, is gone. For the brawny might of the old kingly beasts we have now the crafty intelligence of an inquiline, an alien invader of high survival-value, like the starling.

More observers needed

But the natural history of Kennicott's Grove is not impoverished or utterly tamed for all that. It still carries great biological weight but instead of weighing in terms of the tons of the thundering buffalo herd, we calculate the ounces of food per day or per hour consumed by creatures like the shrews and mice. Once we had the howling wilderness; now we have a subtler Nature, and, I suspect, there is distinctly less of the antler-trophy about it, and somewhat more of modern science. For the essence of natural science is long and minute observation, exact description, experiment, control, and prediction. These may be encompassed as well upon the small scale as the large. Perhaps far better on the small scale. What natural history needs is chains of small-scale observers, preferably better ones than I am, but endless chains of them.

For life itself is an endless chain. I cited the case of the mouse year as a single instance of it. All the time, in my minute field of vision, other cycles were exhibiting themselves, other problems were presented. The biological status of the crow, of the ring-necked pheasant, of the tent caterpillar were just as important. Absorbed in them, one soon drops the amateurish emphasis upon rarity, upon the occurrence of "strays" in the local plant and animal lists. It is the "everyday" organisms, and life's complexity, its vital inter-relations, its unbelievable symbiotic systems, that matter. In your own neighborhood, as in mine, almost all problems are still unresolved, and everywhere, like the spring choir of the marshes, rises the triumphant canticle of life's beauty.

MY MONKEY NEIGHBORS ON BARRO COLORADO—

The unbelievable acrobatic feats they perform high up in their jungle highway; their family life; and the uncontrollable hatred that a group of free monkeys showed toward their captive brothers

By FRANK M. CHAPMAN

Curator of Birds,
American Museum of Natural History

With photographs by the author

MONKEYS possess a greater interest for Barro Colorado's human visitors than any other inhabitants of the island. To see a monkey is the most frequently expressed desire of casual guests as well as of naturalists in residence and it is indicative of the richness of the island's fauna that the desire is usually gratified; or if not seen, at least they are heard and a howling monkey is probably more impressive to the ear than to the eye.

Besides this distinguished member of his family Barro Colorado also claims the white-faced or capuchin monkey, the titi, squirrel monkey, or marmoset, and the night monkey.

The Howler

No Barro Colorado indigene has been more favorably and definitely affected by man's addition to the island's fauna than the howling monkey. Prior to our residence there man was this monkey's foe; now he is a friend. Formerly, howlers were hunted for food; now they are protected as our most interesting neighbors. In 1925-26, the first season I passed on the island, the laboratory clan of howlers, or group that lives about our home, contained thirteen individuals. In 1937 it numbers between thirty-five and forty and is evidently the parent group of the Fairchild clan composed of about ten more.

No studies made on Barro Colorado have been of greater value than those of the howling monkey by Dr. Ray Carpenter under the auspices of Doctor Yerkes of Yale University.* It was on Christmas Day, 1931, that I had the pleasure of presenting Doctor Carpenter to the members of the laboratory clan of howling monkeys. He arrived on the island just as they had assembled in the branches of a comparatively low tree growing from the brookside at the entrance to the Barbour Lathrop Trail, to feed on the fresh foliage, an exceptionally favorable place in which to see them. Never were man and monkey better met.

Trained in the methods of the animal psychologist, with an enthusiasm for his task that placed no limit on endeavor and made all labor a work of love, Carpenter spared no effort to enter into the life of howlers. On their side the monkeys submitted with good grace to his attentions, for the most part accepting his presence as unobjectionable.

Bark worse than bite

For about half of each of the following two years Carpenter may be said to have done his best to become a howling monkey in order to study at close range the life of the individual, the habits of clanmates, and the relations of clan to clan. The results are contained in the publication to which I have referred. It has made the howler better known to us than any other inhabitant of the island. A creature of ferocious appearance, whose amazing voice more than matches his looks, the howler proves to have an even, one might almost say, a sweet disposition. He lives at peace with the members of his clan, rarely reproves the children, betrays no sexual jealousy, in fact will share a mate with a fellow mate. His bark is indeed worse than his bite and his bite is restricted to masticating the leaves and fruit that form his only fare. But so overwhelmingly intimidating are the howler's vocal manifestations that thus far no one has had the courage to question their authenticity, and he lives in security behind a barrage of sound. Some day, someone will call the howler's bluff and discover that his threatening roars and satyric appearance conceal the temperament of a pronounced pacifist. Meanwhile, we may pay a tribute to the howler's eloquence which, better than claws and fangs, has kept him at peace with his associates and neighbors.

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* "A Field Study of the Behavior and Social Relations of Howling Monkeys." *Comparative Psychology Monographs*, Vol. 10, No. 2, May, 1934, Johns Hopkins' Press.

In revealing to us the howler's true nature and acquainting us with his infra- and inter-clan customs, Carpenter has materially closed the gap between us and this monkey. We see him now not merely as a wild animal whose actions are governed fundamentally by the functions of eating and mating but as a creature who has developed a social life designed to promote not alone his own well-being and that of his associates, but, on the whole, the welfare of his kind.

Numbers increasing

Doctor Carpenter's monograph, besides including an intensive study of the howlers' social life, contains also a detailed census of their numbers. From casual observations made on Barro Colorado 1925-26 I estimated the howler population of the island at 70, but in April 1932 Carpenter placed the number at approximately 398. Even allowing for the increase during the intervening period the difference between our figures shows the unreliability of what was little more than guesswork on my part. The following year Carpenter raised his count to 489, plus or minus twenty-five, and expressed the opinion that as Barro Colorado's trees become larger and the area suited to occupation by howlers increases in extent the island might support a population of 2000 howling monkeys. Only those familiar with the howler's potentialities as a sound producer can realize what Barro Colorado will become should this prediction be fulfilled. There have been occasions when, even under existing conditions, the uproar of a clan of howlers, in its volume and continuity, became almost unendurable. Such an instance is recorded in my journal for February 8, 1932. It reads: "Howlers in and near the Panama tree about 200 yards from the Laboratory, where they had passed the night, gave their moaning call at 6:45 A.M., and at 7 A.M. began a family howling which was maintained almost continuously for some four hours. I counted as many as seven outbursts in a minute. Led by a male, the rest of the clan joined. I returned from studying manakins at 9:15 and saw through 24-power glasses a mother with a very young baby to which she appeared to be applying her lips and whose hair she lightly plucked or plucked at. In my opinion, it was a newly born child to which she was giving the attentions required. Once before I have heard a prolonged outbreak and have found a very young yellow baby in the clan that was calling."

I find now, however, that Carpenter who, during the entire morning, observed these howlers from the laboratory, attributes their vocalization to the attempted intrusion of a strange male (Monograph, p. 101). Doubtless he is correct but it is possible that the rage of the home males may have been increased by this ill-considered attempt of a foreign male to enter the clan at a time when it was especially concerned with domestic affairs.

When the leaves are fresh or the fruit is ripe in one of the great fig trees above my house, or when the nearby *Platypodium* is budding, the howlers come to spend the day in feasting on these favorite foods. The hours between breakfast and supper were, until recently, passed in a great broad-limbed tree unknown to us by name, growing between the food-trees. Here the adults had abundant room to sleep, the young, to play, while I often brought out a reclining chair, from which I could easily gaze upward, and joined them below. Eighty to a hundred feet above me my presence merely excited their interest without arousing fear or changing the course of family life.

Some years ago we had as a captive at Barro Colorado a young howling monkey who had fallen from her mother's arms. We named her Claudia. After 50 days of close attention on my part Claudia accepted me as a friend and thereafter revealed such mental capacities that I have ever since longed for an equal intimacy with her father or mother or any other mature member of her clan. But, alas! they remain aloof in the tree-tops, regarding me with a composure which bespeaks an assurance of superiority that serves only to increase my longing for a closer meeting.

Carpenter has shown that mating among howlers is a rather communal affair and that neither child nor parent may be sure of their relationships. The mature males, therefore, assume an attitude of parenthood toward all the children of the clan while they in turn acknowledge as paternal the authority of all adult males. There results an atmosphere of peace. One may hear much of what sounds like conversation in a howler clan but rarely, if ever, do these utterances suggest prolonged ill-will or anger.

Mothers show no anxiety

The young, within limits, are apparently given complete freedom of action and romp actively with each other, exhibiting, at a height of a hundred or more feet, a reckless agility which, one might imagine, would bring maternal reproof. But their mothers recline placidly on horizontal limbs, arms and legs dangling, head outstretched, with no show of anxiety for the safety of their offspring. Such a scene is described in my journal for December 21, 1935:

"At 9 A.M. I see from my porch five baby howlers with their mothers in the fig tree. They are having a true 'sky-lark,' tumbling over and mauling each other, pulling each other's tails and exhibiting other monkeyshines. The mothers sit and look on calmly I heard no 'don'ts' or 'stops' or other automatic, maternal deterrents. The children, unchecked, are having a thoroughly good time. Every now and then they return to their mother for a rest or to induce her to take part in their play, but there is no protest from the patient parent; the great, broad, black face, with its large, protruding, wide-spaced eyes, seemed to show only sympathy and understanding."

This tree of rest and passage proved to have outgrown its base. A year later, with a terrifying explosion, quickly followed by a crash in which six smaller trees were involved, it fell and the monkeys lost both a home and a highway. I chanced to see them when for the first time they visited us after this change in the topography of their route through the forest. Finding that their oft-traveled road no longer existed and being evidently unwilling, perhaps unable, to retreat, they were forced to take a new way. This required a jump, at a slight angle, of not less than 25 feet, a long distance for a howler, who is a conservative traveler. All but three childless animals, probably males, had passed as I reached the place just in time to record their silhouettes as, arms and legs widespread, they threw themselves into the air and landed safely in a bed of limbs and leaves below.

When moving through the tree-tops over regularly used highways, which to them are evidently well-defined, the howlers usually travel single file. The young go with their mother, at first clinging to her underparts, later to her back. Difficult crossings may be bridged by the mother's stiffened body, as she clings with her hands to branches in advance before releasing her tail-hold on those in the rear. The young, who have dismounted while the connection was formed, now go over without hesitation and the journey is resumed so quickly that it is difficult for the human observer to realize just how the passage was made.

An intricate aerial feat

The most pronounced and complicated case of this type of assistance was observed on the morning of March 16, 1929. Returning from a night at Fuertes House I found the members of the Laboratory Clan feeding in the fig and *Platypodium* above my home. At 9:45 they began to move westward through the nutmeg, a route I had not seen them take before during the winter. It was not until all had departed except a mother with a well-grown young I observed that this road called for a jump of about 15 feet downward at an angle of 45 degrees. I had a single plate left in my holders and focussing a tripod camera, armed with a 14-inch lens, on the spot I waited for the mother and baby to make the jump. They came slowly and at the last bit of foliage on the overhanging, take-off limb the baby dismounted and concealed itself in the leaves while the mother advanced and made the jump alone. Assuring her that she had lost an opportunity for immortality I was about to remove my camera when it appeared that the story was far from told. The mother had no intention of deserting her young; her course of action was evidently planned before she jumped.

Turning she now climbed to the top of the tree in which she had landed, reached upward, caught the tip of the branch from which she had sprung and pulled it toward her, thereby creating a bridge between the two trees. At this point the baby howler, who doubtless had been an interested spectator of the proceedings, clearly received his marching orders and, climbing carefully downward, passed over his mother's outstretched arm, remounted her back, and the two hurried on to rejoin the clan. My thanks for the most interesting, perhaps the most valuable, nature picture I have ever made, followed her.

What I had seen, and in part recorded, was not an instinctive, automatic reaction to a situation by which the howler mother had been frequently confronted. To the best of my belief she was traveling over a route new to her. Almost certainly she had not covered it during the preceding three months. Nor is it probable that from her position in the rear she could have seen other mothers meet the conditions she encountered so successfully. Circumstances, therefore, indicate that her plan of action was a prompt and original response to the conditions as they were encountered. Looking ahead she saw the break in the trail and at once decided that it was too wide to be crossed while carrying her young. She had, however, no intention of deserting her offspring and when it was told to dismount and wait, we may assume that she must have planned the sequence of actions which I have described. In short, her actions appear to have been wholly based on original observations and their resulting conclusions.

The Capuchin

Light of foot, of body and of mind, the white-face or Capuchin monkey wins our attention chiefly for his agility, while the howler commands our respect for his stability. Enders† records a 50-foot leap

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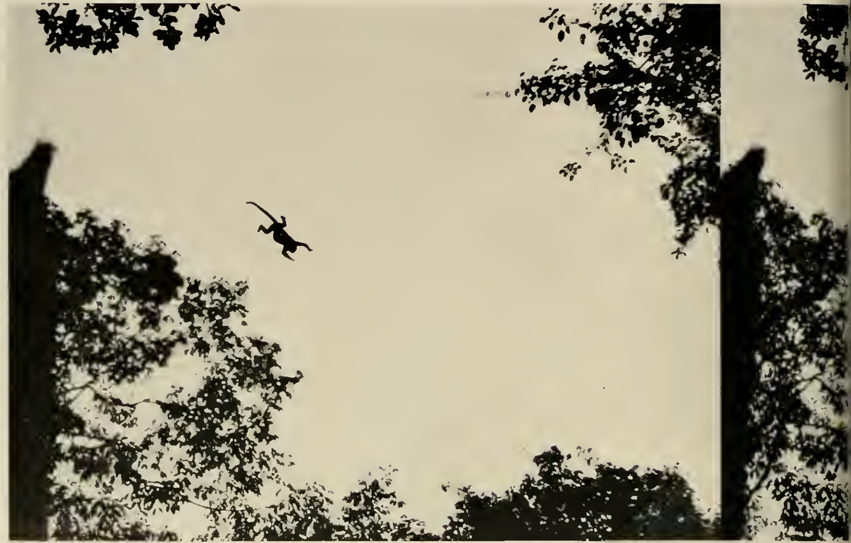
† "Mammalian Life Histories from Barro Colorado Island, Panama," *Bull. Mus. Comp. Zool.*, LXXVIII, 1935, pp. 385-[illegible]

A Monkey Highway

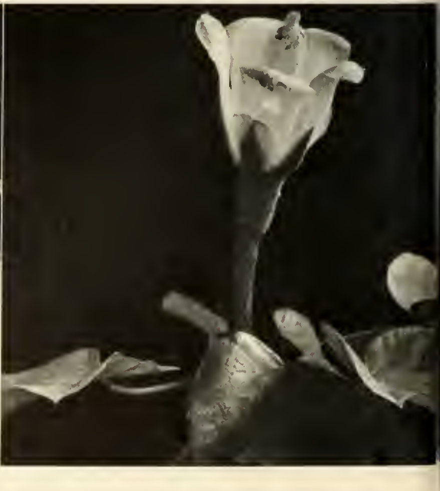
Photos by F. M. Chapman



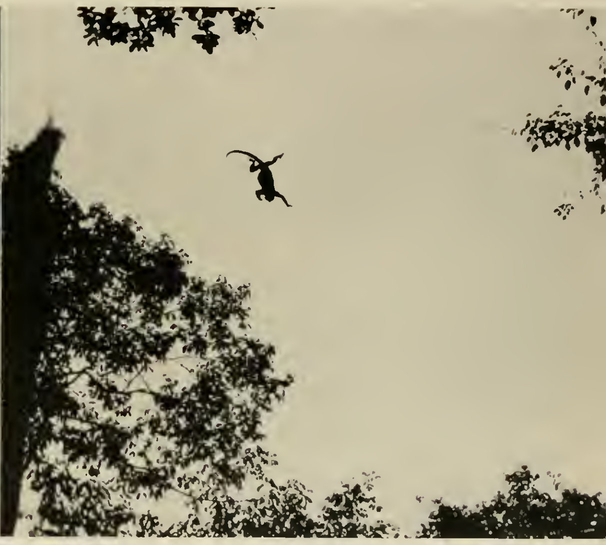
One of a clan of howling monkeys forced to leap a 25-foot gap left by a falling tree. Normally conservative travelers, the band made the transit swiftly, and Doctor Chapman arrived with camera in time to record this spectacular stunt in monkey acrobatics

Silhouette of a capuchin monkey with its head buried in a balsa blossom. This is the familiar organ-grinder monkey. Although docile in captivity, he is difficult to study in the wild, being almost constantly on the go and extremely agile

A balsa flower: favorite food of marmosets. Holding the flower in both hands they sink their heads into it and sometimes pull the petals apart



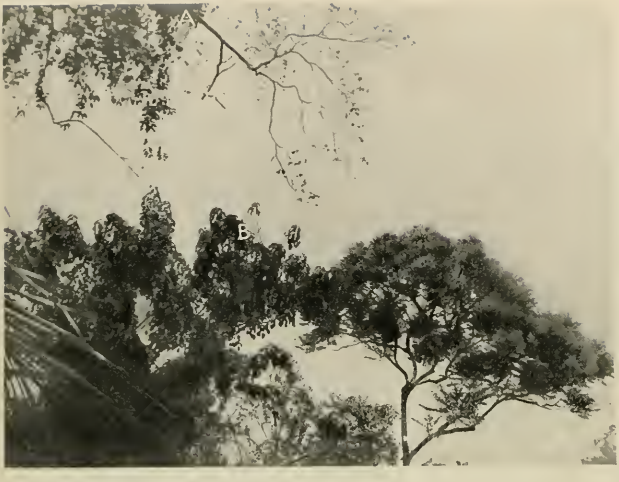
"HE FLIES THROUGH THE AIR with the greatest of ease" and lands safely in a bed of branches. The mother howler shows no concern when her child sky-larks with reckless agility 100 feet up



READY FOR A FOUR-POINT LANDING: a howler with arms and legs extended to break its fall. Note how much like a lizard it looks; though, as every sharp-eyed naturalist will see, the projecting thumbs make the figure unmistakably that of a monkey

"MITZI," A PET MARMOSET which after being in captivity for twelve years escaped the day this photograph was made and was never seen again

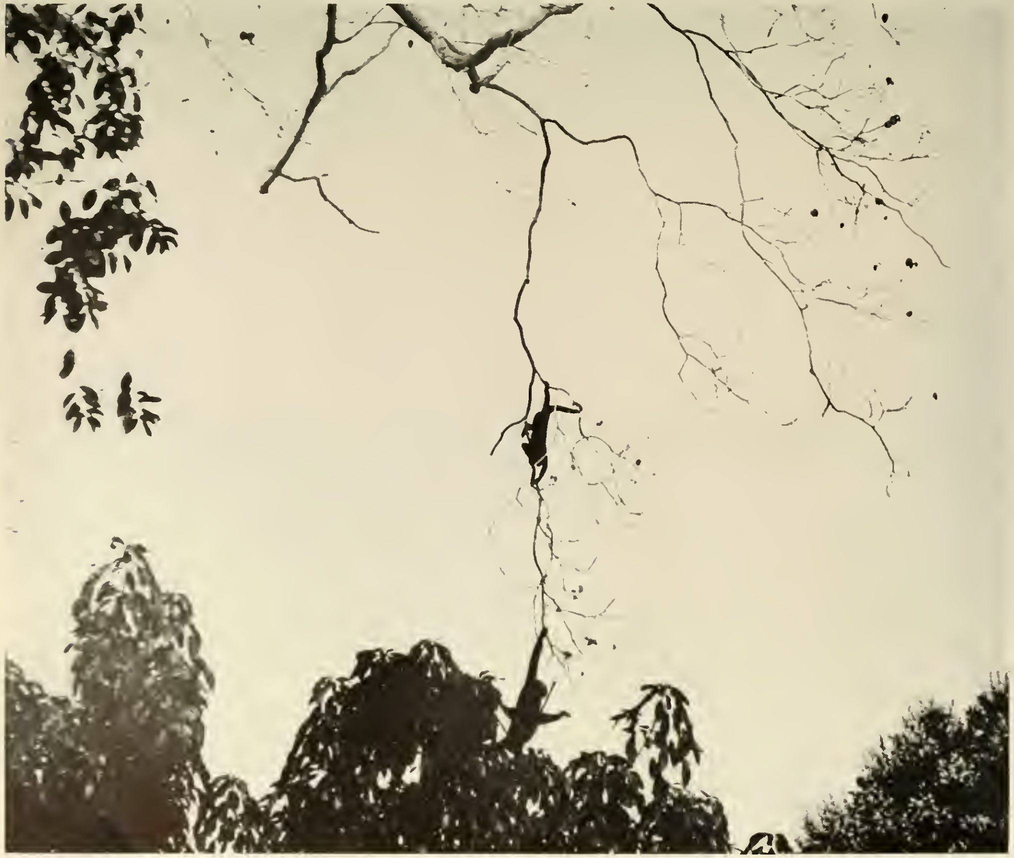
A CAPTIVE NIGHT MONKEY. She recoiled from light as from a blow and would creep into your open shirt to find darkness. At nightfall she would fly with the lightness of a bird on the wing



A Careful Mother

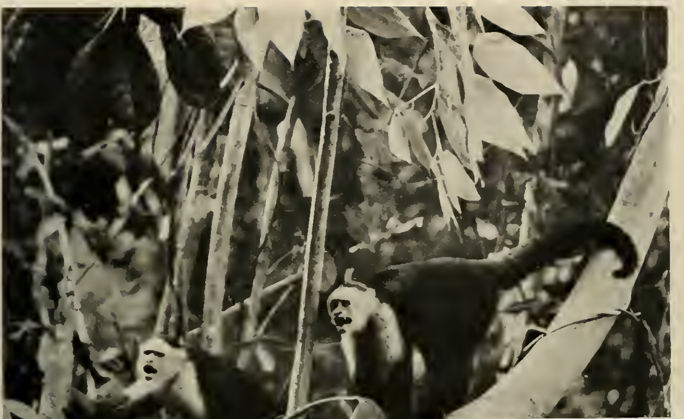
AN INTELLIGENT MANEUVER by a super-gymnast

A MOTHER HOWLER was confronted with the problem of getting her baby from point A to point B. After leaving her baby at A, she sprang from the projecting limb to B, then reached up and drew down the tip of the branch creating a bridge for her young. As shown in photograph below, the baby climbed cautiously down it, to pass over its mother's outstretched arm and take its place on her back. The maneuver illustrates the ingenuity of these tree-top travelers

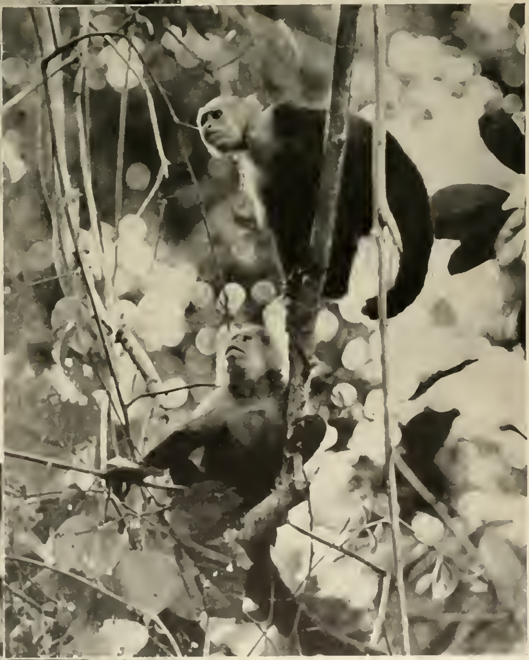


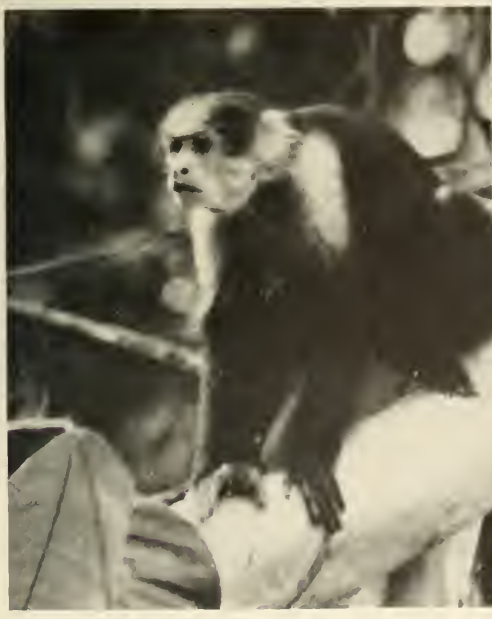
Wild Capuchins Attack Caged Ones

HATRED expressed by free monkeys for their captive brothers: an inexplicable example of monkey psychology. Far from attempting to liberate their unfortunate relatives or bring food, these capuchin monkeys, in a group of from 15 to 20, did everything in their power to express hatred of them



(Right) THE FREE MONKEYS showed their rage by jumping angrily up and down, breaking limbs and throwing them to the ground, tearing vines, and attempting to enter the cage. The captive monkeys cowered in abject fear, screaming as though they were being choked to death





THERE WAS WIDE DIFFERENCE in the facial expression of the attacking monkeys. This one resembles a philosopher. The demonstration lasted two hours for a capuchin but half this distance is as much as I have ever seen the howler cover. Capuchins lack the close clan organization of howlers. A group of thirty or more may be spread out over a distance of a quarter mile or more but the loud, raucous squawk, which is their most distinctive cry, is often heard from one end of the company to the other and evidently keeps its members in touch with each other. They are more or less constantly on the go and are therefore far more difficult to study than howlers. The man who plans to follow a group of capuchins in order to learn its range, has a memorable task before him.

One rarely sees a clan of howlers that does not contain one or more mothers with young, but it is unusual to see a baby capuchin. Hence one concludes that howlers breed throughout the year, capuchins, only at a certain season. Whether or not the latter equal the former in number I am unable to say, but unquestionably capuchins have increased since the island has been protected.

As yet our capuchins have found no Carpenter to record their history. When he comes they will lead him a dance through the forest. On the other hand, capuchins accept with good grace the conditions of cage-life under which howlers sulk and die. One cannot conceive of a howler as an organ-grinder's assistant while the capuchin so readily accepts the indignities of this position that he has made it his own.

Free monkeys hate captives

At the moment we chance to have an adult female and three immature capuchins in a large cage at the entrance to the forest. They are responsive and companionable and one rarely visits them without being reminded of his kinship with their order. But it is the manner in which they are treated by the free individuals of their own kind that chiefly interests us. One might imagine that, as prisoners, they would awaken the sympathy even of strangers of their own species. It would not be surprising if they were brought food by their more fortunate brethren. On the contrary, the captive animals seem to infuriate the free ones. On the afternoon of March 4, 1937, fifteen or twenty of the latter came to the forest sides of the cage and did everything in their power to express their hatred of its inmates, jumping up and down in futile rage, shaking and breaking limbs and throwing them to the ground, tearing vines, making gestures expressive of a passionate desire to do something destructive. They attempted to enter the cage from above and even from the ground and tried to tear the wire from its frame, but never, in their anger and excitement, did they come into conflict with each other, though they often came into contact when two would act as one, jumping and threatening together. It was apparently the three younger animals that were the object of the attack and they in turn showed the most fear. They sought refuge from their apparent would-be assassins by hiding behind a box in their cage. Cowering there they screamed as though they were being choked to death.

This attack continued for about two hours and on both sides was a remarkable and inexplicable exhibition. What was there in the condition of these caged individuals that should so enrage their wild kin? Why should the captives manifest such terror of those that sought to reach them? Two adult capuchins in an adjoining cage, while greatly interested in me, were not concerned with the wild ones, who, in turn, ignored them.

It was a rare opportunity for photography and we availed ourselves of it to the limit of the light, making dozens of "stills" and several hundred feet of motion film. The latter tell the story more effectively. So absorbed were the invading monkeys that we made comparatively little impression on them and they permitted our approach to within fifteen or twenty feet.

Capuchins often visit the balsa tree that overhangs my porch to feed from its flowers. What they find in these great alabaster blossoms I have been unable to discover, but the manner in which they bury their heads in the vase-like openings indicates that they are getting something to their liking. I once saw a capuchin mother, after withdrawing her own head from a flower, change her position so that the well-grown young one on her back might take its share of whatever the flower contained that attracted them.

Aerial acrobatics

The capuchins are super-gymnasts. It is not so much what they do but how they do it that wins our applause. Every act, so to speak, is new, the performer has probably never used this route before but he follows it without a moment's hesitancy and with an assurance that bespeaks unquestioned confidence in his powers. One watches them, therefore, without fear for their safety, knowing that they are as much at home in the tree-tops as a bird in the air. Unconcernedly they skip through the branches, leaping, dropping, swinging, using their tail as a fifth wheel, as it were, when it is required, and always reaching their objective. Looking neither backward in thanks nor forward in prayer, they continue on their way, "masters of their environment."

Every afternoon at about four o'clock, during the period when the trees are blooming, a band of five marmosets appears in my balsas and makes the round of the scores of open blossoms. Their coming forms a regular and attractive part of each day's program as, like a band of coryphées, they enter the tree and dance from limb to limb. And as they romp about, or with dangling tails perch here and there, they utter cheerful little twitterings, trills, and long-drawn chirps singularly bird-like in character.

Resemble shrunken human heads

They are a strikingly marked little people with snowy, white underparts, a pointed white crown-patch, chestnut nape, grizzled back and long, black, wooly tail. Their hard little hairless faces of dark blue, tightly drawn skin framed in white, suggest the shrunken, mummied heads prepared by the Jibaro Indians of southeastern Ecuador. To me there is nothing attractive in their expression. It holds no suggestion of friendliness, or awareness of relationships. They have not the interest in me that howlers and capuchins show. The balsa flowers alone concern them. Sometimes the same flower will be visited three or four times in half an hour, probably by different animals. Often a flower will be looked into and quickly passed; presumably it does not hold what they are after. When what they want is there, they hold the flower in both hands and sink their head in its open top. Often they pull the petals apart in order that they may more readily get what they seek. Possibly, like the bees that crowd to the flowers, they are gathering its juices, possibly they are gathering bees.

As though they were following familiar routes they gallop easily over the long, gray balsa limbs, drop lightly from level to level and with arms and legs outstretched spring across openings eight to ten feet across like winged creatures.

The individuals of this group of five evidently have some type of association. They are on excellent terms with each other. There is no competition for balsa flowers, no hurrying to see who will reach one first. Each animal seems to go his own way and should his path lie in the way of an approaching comrade he may stop, squat, and ask for a general grooming of his coat before the other one proceeds, and usually he gets it.

The balsa across the clearing, next to the brook almendro, is visited by another small group of marmosets. The appearance of both groups is a fixed daily event as long as the balsas bloom. A naturalist resident here during that period might record the marmoset as "a common species of regular occurrence." But a naturalist living here when the balsa was not blooming might describe the marmoset as "uncommon, rarely seen," and both would remain unaware of the fact that in truth it was the balsa flower rather than the marmoset of which they were writing.

The Night Monkey

With the notable exception of Claudia, monkey pets are not my specialty, but I confess that a night monkey, which for a time was owned by our cook, was a winning little creature. It recoiled from the light as from a blow and if removed from the obscurity of its box during the day would at once seek the nearest hiding-place. Should your shirt then chance to be open you might suddenly find yourself possessed of a monkey who thereupon proceeded to search for the darkest place within your clothing.

Normally, Nemesia, as she was called, did not emerge from her daytime retreat until shortly after sunset. Then she was prepared for play and flew about her large cage with the lightness of a bird on the wing. A capital pet, this, for one who is occupied by day.

Sometimes we hear, and more rarely see, these monkeys leaping through the tree-tops at night, and on one occasion I was shown two whose little elf-like faces peered at me from the opening to their home in a tall, dead tree in the heart of the forest.

After a ten seasons' residence in their haunts this is all I have to say concerning night monkeys and it seems obvious that our knowledge of their habits will be gained largely from individuals in captivity. But if this, the fourth of our monkeys, is known to us chiefly by name the daily presence of howlers, capuchins and marmosets is welcome evidence that in spite of the comforts by which we are surrounded we are still inhabitants of nature primeval.

BIRD MEN COURAGEOUS—*A thrilling treasure-hunt by two young ornithologists amid the bleak and eerie rocks of Funk Island, where the Great Auk once flourished*

By E. THOMAS GILLIARD

"THESE boys want to go out to the Funks." The itinerant minister didn't quite wink at the purser of the *S. S. Caribou* as he introduced us, but there was more than a hint of amusement in the voice of this very kind old gentleman.

The purser looked at Sam George and me. "The Funks? Going out to the Funks? Whatever for? Nothing on them old rocks but sea birds and—and stink." The kind old gentleman (we were almost beginning to dislike him) beamed with the air of one announcing a discovery and cut in, "Bones—bird bones. They're looking for bird bones."

The purser studied us curiously. "God bless my soul! You don't say so!"

The extinct Great Auk

Our immediate inspiration for the trip and our guide was a reprint—old and tattered, but nevertheless one of my most prized possessions—of the report of Dr. Fredrick Lucas of the results of his expedition to Funk Island in 1888 for the National Museum.*

Although unable to stay on the island for more than a few hours, he collected many thousands of bones and eventually assembled from this hodgepodge no less than twelve skeletons of the Great Auk, that ornithological prize of prizes which through the greediness and waste of man was wiped out of existence in the first years of the nineteenth century. Because of the inaccessibility of Funk Island and the dangerous waters surrounding it, ornithologists and collectors have shunned it and our research brought to light no recorded visit since the day of Doctor Lucas. Even the fishermen steer clear of it, and we quickly found that this charnel heap out in the wilds of the Atlantic had become enshrouded in a protective superstitious taboo. Our greatest obstacle on the trip was to conquer the unwillingness of the natives to violate it.

Considering that in 1934 at a London auction two of the eighty known Great Auk skins brought $4,615.00 and that all of the existing skeletons had passed long since from the hazards of the open market into the hands of scientific institutions, our venture, if figured from a baldly mercenary point of view, seemed to hold a sporting chance worth the taking. Newfoundlanders laughed incredulously at our project and refused to believe us. This unwillingness to credit us with dealing in the truth—(there seemed to be an idea about that we were a pair of treasure-hunters the Dominion Government was trying to find)—was difficult to combat.

"Them islands? Nobody's been on 'em in forty years. You can't get on 'em! Ain't nothing if you do get there—'cept maybe a few ticlaces and saddlebacks." The purser, an odd sort of being rather startlingly like the old prints of the bird whose remains we sought, flapped excitedly about our pile of equipment as we prepared to leave his boat and gave us a practical lead. "When you get to Fogo—see Earle! That's what you better do! See Earle. He can do anything for you that can be done. See him. Talk to him. Maybe—"

Local aid sought

When we got to Fogo, we saw Earle. Or rather Earle saw us. Walking along the ridge path from his fish warehouse and office to his home, Mr. Frederick Earle, principal merchant of Fogo, spied us on the dock and came down to collect us. In his home we were treated to a taste of the hospitality the minister had assured us we would find on Fogo. A high tea of canned terr—(razor billed auk)—a company staple of the region occupying the same status as fried chicken in Maryland, and we were ready, we thought, to ask questions. Instead we answered them. These bones we were after—what about them? How'd we know they're there. Or ever were? What could we do with them after we got them? Our collection of notes and maps speedily appeared. Our host, his two sons and his two daughters were soon involved in a cloud of explanations and historical data. Knowing that the success of our trip depended in some measure at least upon convincing Mr. Earle of its feasibility and value, we put on a genuine high pressure talk to "sell" the Great Auk.

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*Rep. U. S. Nat. Mus. 1888-89, pp. 493-529 (1891).

In our accounts, Mr. Earle and the boys found the origins and verification of some of the old tales fishermen told on stormy nights, tales told them by their grandfathers of the one-time abundance of this bird and its extermination a hundred years ago. After we had explained that the Great Auk, while in no way a close relative of the true Antarctic penguin, was commonly called a penguin by sailors and fishermen, we read aloud the protest of Cartwright in 1785 against the certainty of the Auk's extermination if men continued to live all summer on the island killing the birds for the sake of their feathers and meat.

"That's all very well," said Mr. Earle after a long, reflective pull at his pipe. "Feathers and meat —I can understand that. But you want to go out for nothing that's any use at all as I see it. What's the use of these bones if you do get them?"

When he heard that in the combined museums of the world there exist but twenty-three complete skeletons, he began to see that there might be some value in the trip.

Ancient mattresses

"Hmm—yes—I suppose if a man's interested in that sort of thing. You know, that man writing about feathers—there's mattresses upstairs might be made of some of those feathers. Those beds have been in the family as long as the family's been here, I guess, and that's a sight longer than any hundred years."

And among the most prized trophies of our trip are the several samples of feathers taken from these balloon-like beds. Although as yet unidentified, if the stories of the antiquity of these beds are true, and we have no reason to believe they are not, it is not at all unlikely that these feather beds are in part made from feathers of the Great Auk.

After due consideration and a thorough survey of the Fogo Island's superstitious fear and dread of the Funk Island waters, Mr. Earle, against his avowed better judgment, consented to use his influence and knowledge of the fishermen and their resources to help us make the attempt.

At length, we were told a certain Captain Coish of Stag Harbor would meet us at the little fishing village called Tilting and discuss possibilities. Mr. Earle volunteered a hearty recommendation of the Captain's skill as a navigator and seaman, and said that we couldn't do better. He added in an undertone that he doubted if there would be another offer of a boat for such an enterprise. We met the Captain and talked it over. He was a small, stocky man with a sea-faring squint to his eye and heavy white brows startling in the brick red of his face. He had a thirty-six-foot, two-masted schooner, the *Trawler*, equipped with a kerosene burning motor, a bossy wife and the pocketful of *ifs* and *buts* we had come to consider an integral part of every Fogo Islander's make-up.

"If the price is right . . ." We fixed that. "If the sea goes down." "If I can get the right crew." "If my wife . . ." "If you'll do exactly as I say . . ."

Disturbing tales

We made all concessions—agreed to anything that would get us to the island. We listened to all of Mrs. Coish's dark hints as to what *might* happen "out there" with a straight face. We were properly horrified at the story of the disaster of Horse Island where a marooned group starved to death. We heard the story of the madman of Funk Island, whose screeching spirit is supposed to outscream the gulls.

Pending our departure we spent several days of waiting in a task which was of great value in convincing the Fogo Islanders of our essential madness —that of collecting empty bottles, beer, whiskey, castor-oil, wine, anything that would hold a cork. In each of these we inserted a blank which the finder was to fill out, giving the date and place of its picking up, and return to us at the American Museum of Natural History. These we intended to set afloat east of Funk and hoped that reports of their travels might add to the knowledge of the currents of this region. Two bags of these messages reposed in the hold of the ship.

We were surprised within less than a year after setting the bottles adrift to have heard from no less than thirteen of them. Most of the replies were from Ireland, the bottles having drifted southward in the Labrador Current and thence in the Northeast drift current, approximately 2,400 miles. Others reached England and France, one of them touching land near the border between France and Spain.

Under sail, but depending on the kerosene motor for most of her power, the *Trawler* one pitch dark night snorted her noisy way between the narrow, echoing walls of the rocky cove and out to sea. Daylight brought us a sight of Outer Wadham lighthouse and a warning hail from a solitary fisherman. He was drifting with the current, yanking in cod from both sides of the boat and chewing tobacco with a singular intentness. His answers to Skipper Coish's questions were non-committal, evasive, and it was not until the Skipper had convinced him of the *Trawler's* innocent intentions that this wary individual straightened up, wiped the tobacco juice out of his whiskers, and talked about the weather. His words came in shouted gusts as the *Trawler* pitched and tossed, but the gist of them was that you couldn't tell a thing about it. We triumphantly grabbed on one sentence and wagged it under the noses of Captain Coish and his crew the rest of the way out. Old Whiskers had yelled, "You know how 'tis, Cap'n. Sometimes when she's rolling a bad ground swell inshore she ain't nearly so bad out. You can't tell 'til you gets there. You might be able to make it."

Ban on singing

Looking out over the bowsprit Sammy and I tried to ease our troubled minds—and stomachs—with a little song. This was one of the things the Skipper's wife had been most specific about. "Don't sing. It's very, very unfortunate on the water."

The Captain padded forward at our first quavering notes. "Sorry, you know what the Missus said. Now we're beyond Wadham—no singing and no whistling. And no swearing either. It's unlucky. When we get in past Wadham again then you can sing and whistle if you feel like it." He didn't mention swearing. He realized probably that if, on the return, we had no reason to feel like singing and whistling, we would be well justified in a little swearing.

A heavy fog bank whirled in from the northeast. The pitch of the ground swell became greater and more vicious. The two older sailors, the snaggle-toothed one and a lean party with a morbid interest in the possibility of my becoming seasick, retired to the stern with the Captain for a gam, or chat. The result of this was immediately apparent. An order was given apparently by gesture—we heard nothing—and the sails began to pop and flap. Sammy and I realized that the *Trawler* had put about and was headed again for Fogo. We protested, but to no avail. The Skipper shook his head and refused to talk about it. Sammy sighed, flung open the hatch and dragged out the bags of bottles. Believing that we were as far out as we were going to get, we mournfully strung these bobbing couriers in our wake.

For two hours we backtracked through the cotton batting fog that muffled the noise of the antiquated motor. Then the fog swept up and out. This time orders were yelled, and with even a little enthusiasm, mostly expressed by old Pete, the *Trawler* put about again and out to sea.

The swells abated and, in a little while, the weather had cleared enough for us to get a view of landless horizons in every direction. Our little craft seemed to bounce up and down in the middle of nowhere. Hanging onto the bowsprit, my myopic eyes searched the east. Suddenly from behind me came a raucous yell—"Funk Island—there she be!"

I strained my eyes and straight ahead, a tiny speck, marring the meeting of sky and water, lay Funk Island. The Captain, walking up and down the decks, seemed anxious and kept a weather eye aloft for storm warnings. As we came closer to the island from the southwest, it looked as if it might be possible to effect a landing on that side. Closer observation proved this impossible. A turbid white line of foam and crashing water revealed the heavy ground rollers pounding in over the slippery rock. According to Lucas, a point on the seaward side which he called "The Bench" offered the only practicable landing point, and it was with a great deal of anxiety that we scanned the surf for an indication of its presence. Hastily we flipped the pages of his report, and we discovered the Bench at exactly the point where our scorned book learning placed it. This somewhat fortified our Captain and crew. Old Pete was particularly intrigued and, as he said, "confounded" by it, and suggested that "seeing, Skipper, as the boys seems to know what they're shooting at, why don't you let 'em try for a landing?"

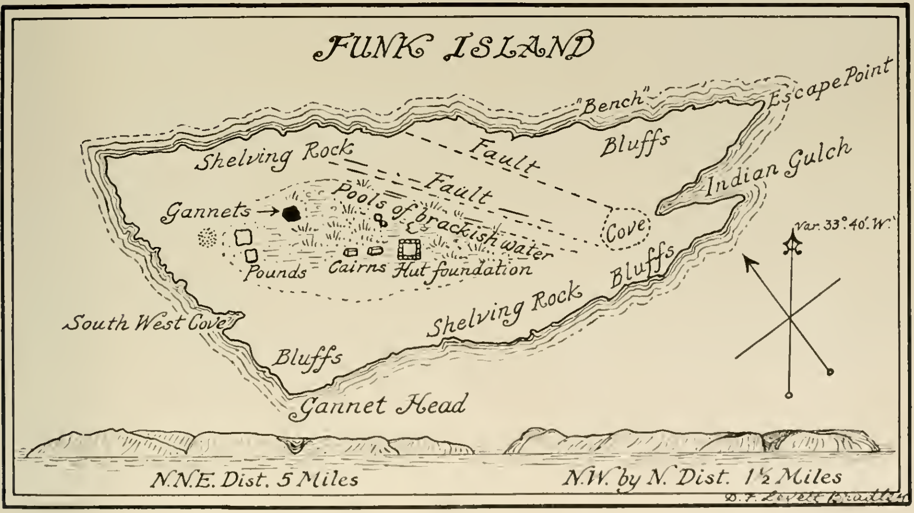
As Doctor Lucas points out, however, the traveler must be favored by proper conditions of wind and weather to effect a landing even on the Bench. And we hoped we would not suffer the difficulties of a collector whom he mentions who lost a fortnight in trying to land and then gave it up.

Landing attempted

There wasn't much time for deliberation—it was by now late afternoon—but the Captain took it. After extracting from us a solemn promise that on his signal we would instantly return to the landing place to quit the Island, the Captain, Pete, Sammy and myself set out in the punt to attempt the landing. Besides our cameras, burlap bags, spading fork and trowels, the Captain would permit us to take nothing ashore. He was openly skeptical about our willingness to return to the *Trawler* if we had supplies enough to last us a few days.

Crouching in the stern of the punt as the Captain and Pete jockeyed her in toward the Bench, ready to make a jump for it, I was startled by a momentary glimpse of a large, white bird in flight over the shelving rock of the island. From out to sea; we had seen on the rocks a moving white that was difficult to account for. Now, surprised and incredulous, for only last year Mr. Wynne-Edwards, on a survey of the gannetries of this region,* passed Funk Island and pronounced it barren of these rare birds, I yelled, not as an announcement, but as a question to Sam: "Gannet?" Sam yelled right back: "GANNET!"

After several abortive attempts to get close enough for a jump, an incoming swell lifted us in. Pete and the Captain pulled mightily against the oars to keep from smashing into the cliff. At the peak of the wave, an explosive "GO!" from the Captain gave me my cue and I jumped, and at last stood on—or rather clung to—Funk Island.



The weather of forty-eight years had worn the Bench from its width of four feet at the time of the Doctor's visit to a meagre two and one half feet. Otherwise it answered exactly his description. Gouging fingers and toes in any tiny crevice for hold, we laboriously scrambled up the twenty-foot face of granite.

"Now for those gannets!" wheezed Sam. The gannet suffered almost equally with the Great Auk the ravages of feather hunters and has become so depleted in numbers that but four nesting grounds are known, all in the Gulf of St. Lawrence. To these four, we hoped to add a fifth, and for the time being forgetting our original objective on the island, skittering and slipping on the wet smoothness of the rock, we headed toward the interior of the island in the direction in which the great white bird had disappeared.

The island is cut longitudinally by two large, trough-like faults and these, cluttered with broken rocks and heavily splattered with the droppings of the nesting kittiwakes, were difficult to cross. Nesting also in the rocky ledges lining the faults were razor-billed auks. The legend of the madman of Funk, as told in Mrs. Coish's somewhat florid and over-emphatic style, had seemed unreal and impossible. Here, in this wild place, under a dark sky misting down a drizzle of rain, with the incessant shriek of the gulls battering at our ears—it took on color and unpleasant reality.

We began to find dead puffins, razor billed auks and even a snowy owl, lying on the ground ripped and torn. We wondered what animal's work this could be. The question was not answered until, back on the *Trawler*, the Skipper told us that it was not at all unusual for Arctic fox to be carried to the shores of coastal islands by the ice-floes of spring. Immature black-backed gulls squawked and scuttled from under our feet. Their coloring so matched the rock that we might easily have stepped on them without knowing it if they hadn't cleared out in a hurry. Old ones flapped angrily ahead; young ones squalled, fell over into the sticky guano, got up only to tumble over again and get the other side smeared, and finally gave it up and just sat.

We, too, were having difficulties with footing.

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*Wynne-Edwards, V. V., M.B.O.U., "The Newfoundland Gannet Colony: with recent information on the other North American Gannetries"; *The Ibis*, July, 1935.

The slipperiness of the water-soaked guano and the great number of young birds underfoot made progress difficult and it was only by stopping short that we could give any attention to the hundreds whirling about our heads. With the landscape obscured by rain, it was impossible at first to find in this enormous congregation of little wearers of Tuxedos and boiled shirts any trace of the birds we looked for. Then—a flash of white against the gray sky—a gannet slid swiftly in from seaward; changed its graceful flight to an awkward flapping and pancaked into an abrupt and clumsy landing just beyond us.

Unrecorded from this island since the days of Cartier, and definitely reported by Doctor Lucas to be extinct on it, we found at the site of this clumsy landing, the re-establishment of the gannet on Funk Island. Seven nests were grouped together in the midst of the teeming community of murres, each cradling a big-headed, dingy looking chick. Flapping about or sitting on the rocks, long necks twisting to keep us in view, were over forty adults. It is curious and perhaps significant that, instead of nesting in the rough cliffs of the island, these gannets have shown a preference for the slope and for the company of the murres. It may be that this preference indicates that these pioneers are emigrants from the crowded Chimney Rock gannetry, a flat topped, gigantic pillar, rather than from the cliffs and rocky ledges harboring the birds of Bonaventure and Bird Rock.*

Threatening clouds

Scarcely stopping long enough to photograph the gannets although we felt the finding of this breeding ground well worth the trip, we heeded the warning sky and cut back toward the peak of the island. Sammy located the remains of the walled pen into which the auks were supposed to have been driven for slaughter, while I started for the ridge to see what had happened to the boat and Skipper Coish's blood pressure. Fearful of an instant command to come aboard, I peered over the ledge. The *Trawler* lay out some distance; the punt drifted quietly a few hundred yards out. I hurriedly scrambled back down the slope to find Sam lying on his side, arm buried to the elbow in a puffin burrow.

"What the—?"

"The puffin burrows are full of 'em!" excitedly yelled Sam, and yanked out a handful, not of puffins as one might expect, but of bones—bones of the Great Auk. The old saying that the more you have the more you want holds true for ornithologists as well as misers. We had found our gannet colony; in our hands were certainly bones of the Great Auk, for one of the pieces from the burrow was unmistakably a mandible. And yet—after three minutes out for jubilation, back-slapping and mutual congratulations which consisted principally of trying to mash one another into the rocky terrain of Funk Island—we became critical and started a hunt for bigger and better bones.

Our hurried digging and scratching of the surface soil revealed that the shallow earth was filled with bones, weather-worn, broken and crumbling. Pressed for time and with two very real and constant threats—the likelihood of increasing bad weather and the certainty of Captain Coish's increasing bad temper—hanging over us, we grubbed and piled the fruits of our grubbing helter-skelter into the bags. Although not according to the best archaeological practice, this seemed at the time as good a method as any. The skeletons had been so disintegrated by weather and the burrowing of the puffins that the finding of articulated bones was out of the question.

A break in the clouds at the west poured out on the sea a flood of angry copper color. It was sunset and with a start we realized that we had better see about getting back on board the *Trawler*. Dragging bags of bones and cameras, in a thoroughly anxious and tired hurry, we negotiated the two faults and slid down the wet slope to the Bench. The punt waited close in. The Captain had always openly disapproved of profanity and would certainly object to being held up as an exponent of the sailorman's art, but now he really let loose. He had been waiting out there for a long time. The difficult job of embarking us and our bones was accomplished with the loss of nothing but steam.

Skulls lacking

Cold beans and hot tea! Then while the *Trawler* chugged further out to avoid any chance of being caught in dangerous shoal waters during the night, we sat on deck and pawed over our collection. Bones of all sorts and sizes and in all quantities. We checked them over with drawings and photographs of assembled auk skeletons. Leg bones, short and very solid little wing bones, vertebrae, ribs, upper and lower mandibles. The Skipper said he'd hate to leave us on the island for a week because the *Trawler* would sink before she would hold it all. When we told him that in spite of this seeming superfluity of bones, we still didn't have all we wanted, he gasped and stomped away. Our check-up had shown that, in order to make up any first class skeletons from these remains, we needed skulls in good condition. And we didn't have a one!

The next day, after a great deal of talk and sev-

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*E. T. Gilliard, "The Gannets of Funk Island," *The Auk*, July, 1937 eral hours of cruising around the island in the punt trying to find a landing place (our former harbor—the Bench—was now beaten by angry waves owing to a change in the wind), the Skipper finally consented to attempt to land us on the southwest shore. At the expense of a wetting, we made it and, with the Captain's injunction to return the moment he signaled ringing loud in our ears, we hit for the center of the island. This trip we had the 35mm. movie camera along and hoped for enough light to adequately picture the gannetry.

We had been there but a scant thirty minutes, when, in spite of the racket of waves and birds I could not pretend not to hear the Skipper's yells and his tom-tom beat on an empty kerosene tin. Going to the water's edge, I was told in no uncertain terms to "get that other idiot" and come aboard. Finding Sam with what he said was just another such miscellany of bones as we had already taken aboard the *Trawler,* we checked over the equipment hastily and resentfully chucked the spading fork and trowel, useless items, among the tumbled stones of the old slaughter hut as a memorial of our visit.

Cursing the malignancy of the weather and suddenly very tired, we stumbled over the tussocks of grass that fought for life in the cracks of the rock. Cutting across our path lay one of the brackish ponds which spot the island. Less tired, less disappointed, we would have skirted its narrow borders for fear of wetting some of our photographic equipment, but with everything seeming so at an end, into it we splashed. The waters were clear and devoid of vegetation. The slippery rock bottom sloped gently in—shallowly. Splattering through its inches of water, breaking the mirror surface into ripples that were a tiny, mocking likeness of the swells out to sea defeating us, we were arrested by whiteness along the inner edge of the pond.

There, pulled down from the earth slope above by the high flung waves of winter storms and by them washed clean of all soil, the bones we sought lay in a great window, thousands of them. To the devil with the sea and to the devil with a shouting Skipper. Without rolling up the sleeves of our sweaters and without going to the margin to drop our packs, we plunged our hands into the knee-deep waters, grabbed for good pieces and stuck them, all wet and dripping inside our shirts.

"Skulls—look for good skulls!"

"I got one!"

"Me, too!"

"And another!"

Our greatest anxiety getting aboard the punt was that in the pitch and toss of embarking, one of the precious skulls might be crushed against a thwart.

On the *Trawler,* we found the crew had taken rather literally the predictions of Mr. Coish that "something's sure to happen to them fool boys." They candidly explained that, believing we would have no need of it in this life, they had devoured as a sort of memorial feast, the jar of marmalade we had been saving to celebrate with. But we were content to celebrate by singing. Pete did all the protesting. He'd been in the punt and hadn't got any of the marmalade.

After our days on the schooner, the *S.S. Caribou,* when we boarded her again at Port-aux-Basque, seemed palatial. As we staggered aboard with dunnage to add to our pile on deck, our old friend the purser, watching from the galley window, was consumed with curiosity. He managed to contain it and in conversation to refrain from asking specific questions, until the gods of coincidence jolted him out of his good manners. Up the gangplank, hurrying and puffing, trudged our mentor of the trip up—the minister.

"Look, sir! Look here, sir! They're back," the pursuer opened briskly. "You remember—the Funk Island boys! Don't know how they made out, but it looks to me they're got more than they started with!"

The minister was more direct, and was sincerely and obviously pleased at our report of a successful trip. The purser seemed disappointed when into his great ham of a hand we laid a Great Auk skull for his closer inspection.

"This is *it?*" He apparently expected something of elephant size and magnificence. "What's it worth?"

We had said nothing about the possible market value of Great Auk remains on the trip up, but now, for the purser's edification, made a few rosy estimates.

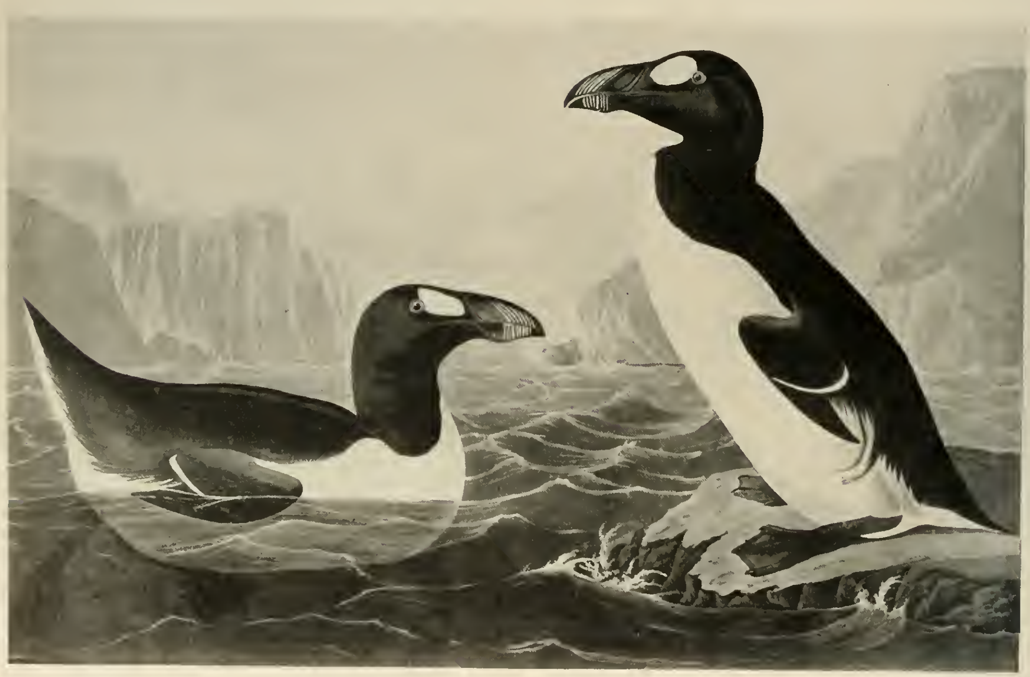
"As much as that? God bless my soul! You're joking!" He tenderly and gingerly returned the skull to its cotton lined box. "God bless my soul!" And, in his awkward, bird-like fashion, flapped off down the deck to spread the story. And, his explanation of the affair, as we caught it in a final scrap as he disappeared down the companionway in the direction of the bar with his friends, seemed to Sammy and me to be as good as any.

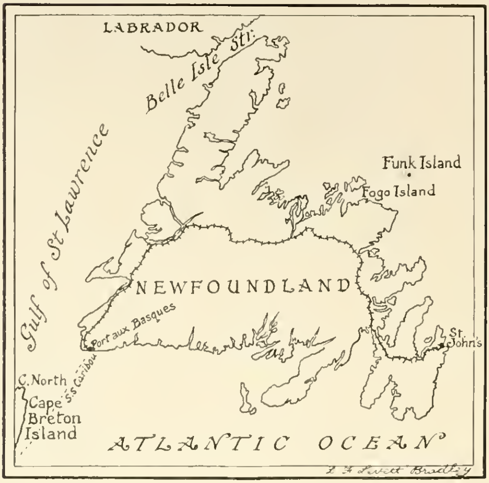
"You know what I calls it? Yankee luck—damned Yankee luck! That's what I calls it."

And Yankee luck we call it.

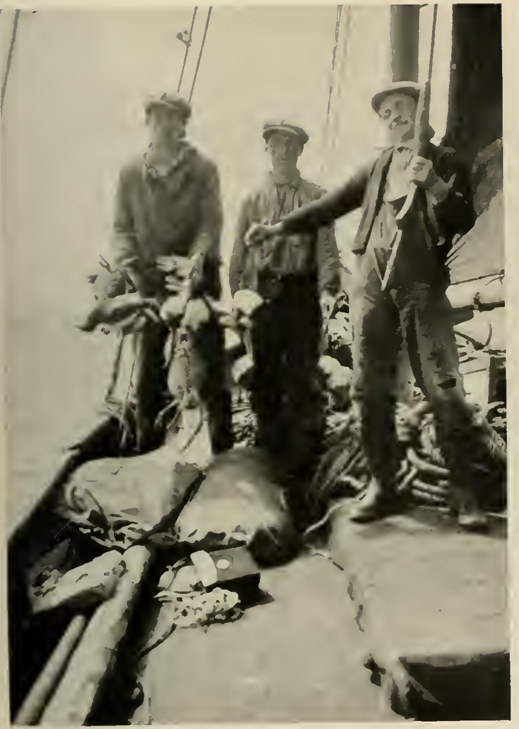
Bird Men Courageous

(Below) AUDUBON KNEW AND PAINTED the Great Auk, and his conception of the famous species is reproduced below, but the ruthless savagery with which the birds were hunted has long since relegated them to the doom of the Dodo—extinction. One of their last breeding places was Funk Island—a sea-washed, fog-enshrouded stretch of rocks off the coast of Newfoundland. To these gloomy shores which had not known human habitation since the palmy days of Great Auk-hunting, came Tom Gilliard and Sam George—adventurous bird men seeking ornithological treasures among the Great Auk's remains




LABRADOR
Belle Isle Str.
Gulf of St Lawrence
Funk Island
Fogo Island
NEWFOUNDLAND
Port aux Basques
S.S. Caribou
St. John's
C. North
Cape Breton Island
ATLANTIC OCEAN
L. F. Lovett Bradley

(Left) THE FUNKS: the map shows the former home of the Auk in its relation to Newfoundland. So unpredictable are the waters and so treacherous the shoals separating the islands from the mainland, that even the dauntless native fishermen give them a wide berth

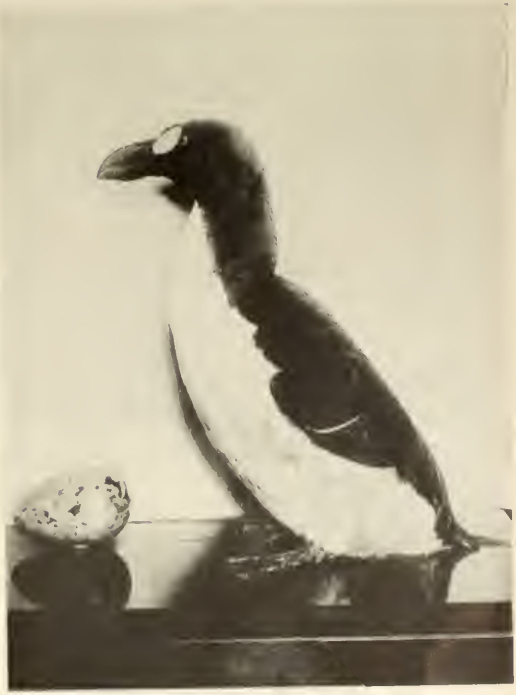


How EXTINCTION WORKS: Conservation is practically unknown in Newfoundland, and history repeated itself when the *Trawler's* crew gazed at the teeming bird-life on and about Funk Island. A hereditary itch afflicted their trigger fingers; muzzle-loaders appeared like magic; and then the slaughter began. Above, three grandsons of the men who helped club the Great Auk out of existence are posed with a few minutes' killing

(Below) MORE THAN TEN THOUSAND birds now flock on the barren rocks of Funk Island whose whole area is about the size of the average baseball field

(Above) THE MYSTERIOUS ISLAND: weird legends had tabooed its shores to many superstitious fisherfolk. This psychological obstacle and the fact that there were no local records of anyone negotiating a landing were overcome by the bird men's persuasive talents

(Below) DEAD AS THE DODO: one of the four Great Auk skins in the American Museum, in mounted form; the egg is a plaster model. Great Auk skins are extremely rare: only 81 are extant in the Museums of the world



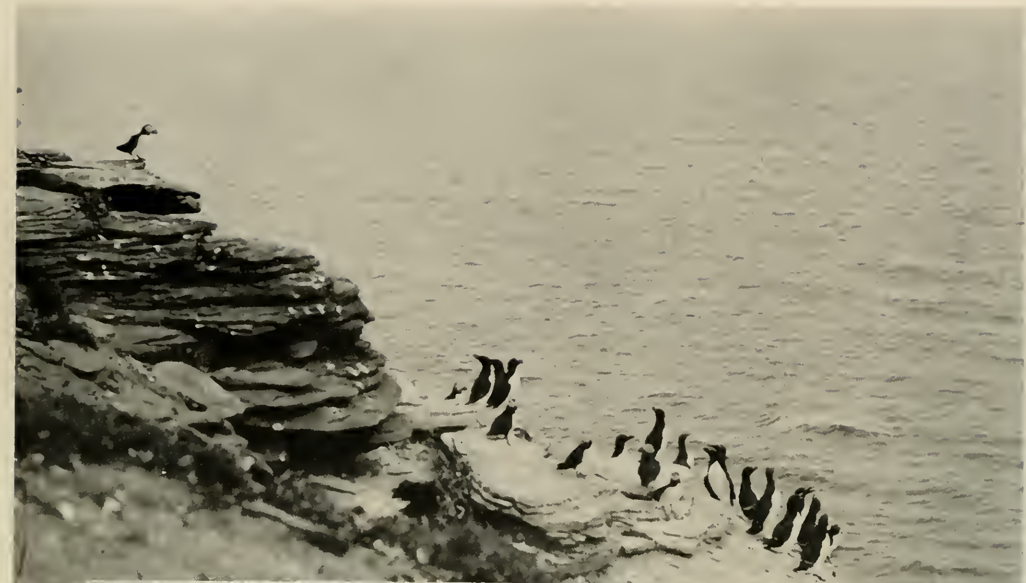


Photo by F. M. Chapman

(Above) A FEW BIRD-TYPES that make their home on Funk Island. This group contains puffins, murres and razor-billed auks. The latter is the closest living relative of the Great Auk

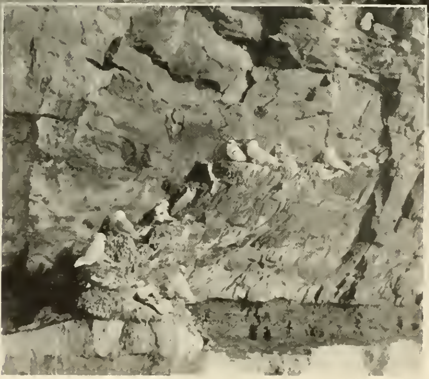


Photo by F. M. Chapman

(Left) KITTIWAKES or ticklaces, a species of gulls. Newfoundlanders take these birds from the nest when three weeks old and raise them in captivity. Under a controlled diet they become very edible

(Below) MYRIADS OF MURRES make up a large part of the Island's bird population. About 100 years ago, a company was formed at St. John's to exploit the guano deposits on the Funks. Although guano was plentiful, the company failed because of the navigational difficulties involved

(Below) EXILE'S RETURN: until the birdmen saw his white wings (center of picture) with their own eyes, they were convinced that the gannet had also been wiped off Funk Island. Their expedition confirmed the re-establishment of this species here

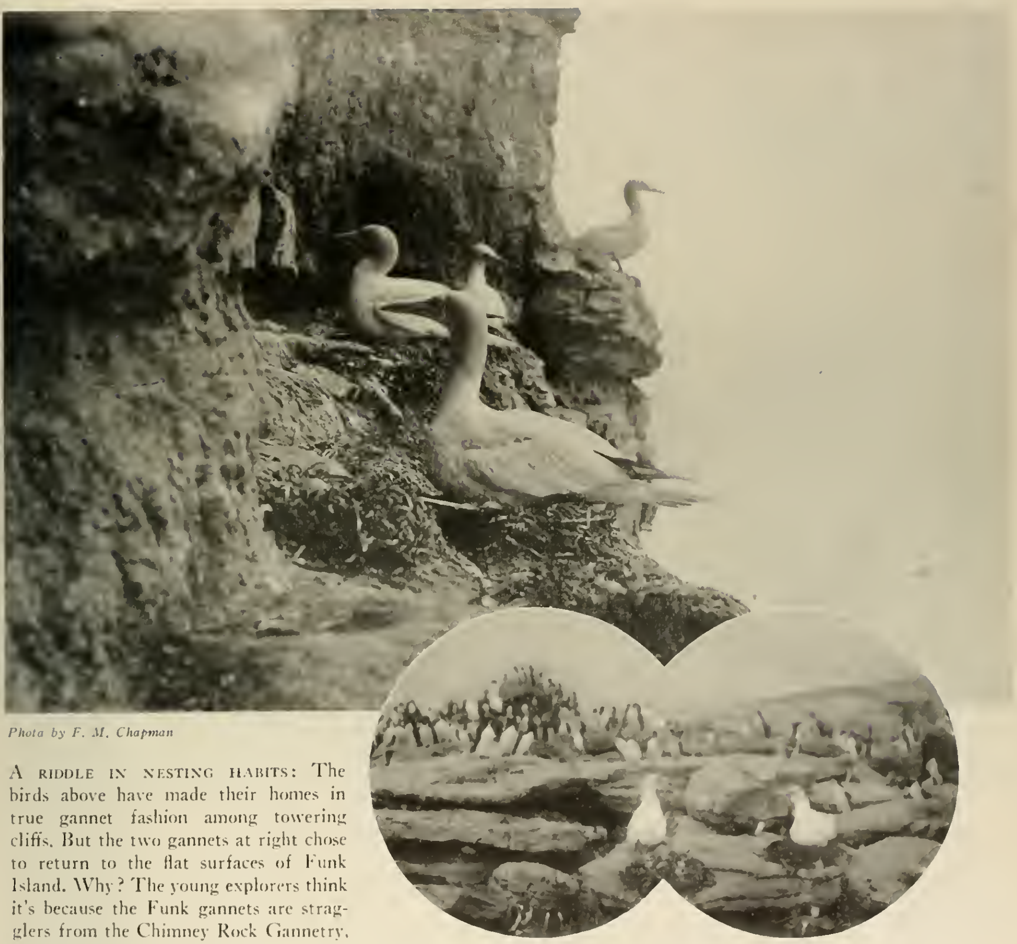


Photo by F. M. Chapman

A RIDDLE IN NESTING HABITS: The birds above have made their homes in true gannet fashion among towering cliffs. But the two gannets at right chose to return to the flat surfaces of Funk Island. Why? The young explorers think it's because the Funk gannets are stragglers from the Chimney Rock Gannetry, where flat terrain is favored

(Below) RUINS OF THE PEN where the Great Auk was once herded by its human exterminators. Murres now raise their young on this dark and bloody ground

(Below) YOUNG MURRES in untold numbers are now growing up on the Island without fear of their human enemy

(Below) THAT KITTIWAKES NEST there in profusion, is ample proof of the island's undisturbed isolation, for they are extremely excitable and shy. Not infrequently does a whole colony disappear when one nest is disturbed by man

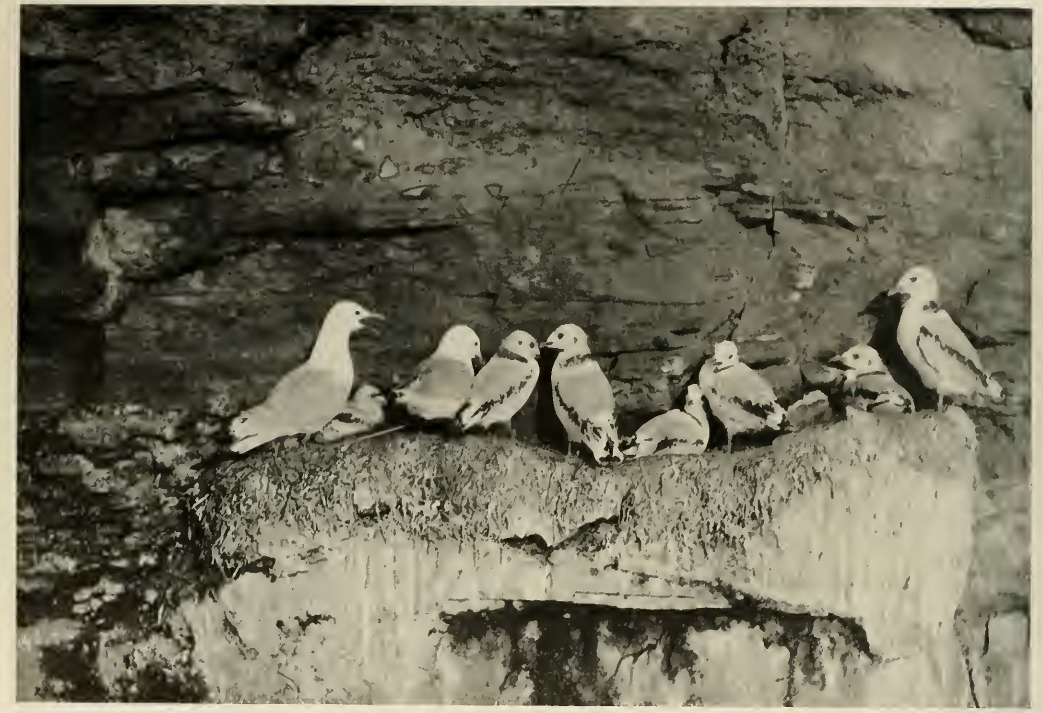


Photo by F. M. Chapman

(Below) NOT A BEACHCOMBER'S shelter after a night's frolic, but the camp where the two bird men spent 16 days before shipping to Funk Island. The pile of empty bottles near the tent was collected for the sober purpose of charting the currents in Newfoundland waters. With a message addressed to the American Museum sealed inside, each bottle was dropped overboard en route to the Funks. Information of great interest to oceanographers resulted from the experiment, and bottles drifted as far away as Bilbao, Spain

(Below) ALL THAT IS LEFT of the bird that once ruled Funk Island. Sam George, an ornithological Hamlet, ponders over a Great Auk skull while sorting the treasure horde of Auk bones which he and the author unearthed. The impatient, superstitious ship captain would only allow them a bare six hours to canvass an unknown island, yet their collection is one of the most important of its kind. From the bones collected, a mounted specimen is now being made at the American Museum

TO THE QUEEN OF SHEBA'S LEGENDARY CAPITAL

—*A lone explorer's story of encounters with fierce desert tribesmen in a section of southwestern Arabia never before penetrated by a white man*

By HANS HELFRITZ

The task of exploring unexplored country is not an easy one. This fact, which I never doubted, became increasingly clear to me as I sat in a prison cell deep in the interior of southern Arabia. Criminals are supposed to repent in prison, but I was not ashamed of my crime, which consisted of my being the first white man ever to cross the southwestern part of the Arabian peninsula.

My prison was situated in Harib, in innermost Yemen. I was to remain in prison until the king of that country decided what to do with me. It took him about three weeks to make up his mind. He might very well have ordered my execution. I was not only a foreigner, but an infidel. But he did not have me killed. Although he was the medieval despot of a country which in many respects was at an even earlier stage of development than Europe of the Middle Ages, he chose a singularly modern way of dealing with an undesirable intruder—he deported me. I was released from prison and packed off bag and baggage under military escort, across the mountains of Upper Yemen to Sana, the capital of the country, and then to Hodeida on the Red Sea.

A cruel blow

Had he set his mind to the purpose, the king could have contrived no more devilish punishment. Two years before, my first expedition to southern Arabia had not even gotten as far as Yemen because I could find no guide willing to lead me through a region infested with murderously hostile brigands. And now, just when I was beginning to find interesting traces of the Sabean culture on whose investigation my heart was set, I had been seized and clapped in prison. But when the king commanded his satelites to conduct me to the borders of his realm, he dealt me the most cruel blow of all, for I was led through territory which literally teemed with archaeological treasures. Relics of the ancient kingdom of Saba (the Biblical *Sheba* whose Queen is so well known) were on every side. At Behan and near Harib, I saw stones covered with Sabean inscriptions and the ruins of many palaces as well.

I saw all this with my own eyes, and yet I was not at liberty to stop and examine anything. If you can imagine a hungry man in chains passing between two long, heavily laden banquet tables, you will have some picture of the way I felt on that journey. If only they had permitted me a few days to study these things, if only they had let me have even an hour or two at mysterious Shabwa, the city of the illustrious Queen of Sheba and the very heart of the ancient Sabean nation. But, we did not even pass near Shabwa.

So ended my second expedition.

Renewed determination

But it did not discourage me; if anything, I was fired with an even greater determination than before. I had already gotten farther into southern Arabia, nearer to the center of Sabean culture, than any other white man, but I was not satisfied. I wanted the ultimate, I wanted to explore Shabwa.

About two years later, in February, 1935, I began for the third time the ascent of the South Arabian Mountains. Before me lay the district of Hadramaut, itself known to few men of my race, and beyond Hadramaut the absolutely unknown Shabwa.

Topographically, Hadramaut is a conglomeration of steep cliffs, one or two plateaus, and deep canyonlike valleys, where rivers once flowed in an almost forgotten age. It is only in these valleys that places can be found fit for permanent human habitation. Taken collectively, the towns and settlements are separated from civilization by a veritable Chinese Wall of fanatic Mohammedanism.

As you approach these villages you are amazed at the sight of genuine skyscrapers, dating from a time when the colonization of America had just begun. You will notice too, that they are built with an architectural purity of line that cannot be found elsewhere in Arabia. They are all constructed of a clay material like the adobe of the Indians in southwestern United States. The buildings are examples of architectural improvisation. There are no plans. Construction is carried on according to an art that has been handed down by word of mouth from one generation to another.

In these lofty structures you see reflected the impenetrable, forbidding character of the entire region. And you do not have to seek far for an explanation of their fortified aspect. Southern Arabia is always at war. The tribes are constantly engaged in some feud or other and the onslaughts of the Bedouins occur with such regularity that every traveler must be prepared not only to see, but, as often as not, to become embroiled in, one of them. Therefore, each building must serve the double purpose of a dwelling and a fort.

This was the country through which I had to pass before I could hope to approach the even more difficult environs of Shabwa. I knew that I had to face the same obstacles that had thwarted my first expedition. Where could I find Bedouin guides willing to brave the dangers that lay ahead? At this point my luck had a turn for the better. It so happened that when I started making inquiries about guides an important Mohammedan festival called El Arafa was about to be celebrated. Orthodox procedure in this festival requires all the Bedouin tribes who are usually fighting each other in almost all sections of the mountains, to return to the districts and towns which are their places of permanent residence.

A Bedouin escort

This gave me an idea. I would accompany a band of Bedouins at Seyun who were returning to their homes in Shabwa. After long negotiation, in which I was assisted by the royal family Al Kaff, I finally persuaded a Bedouin of the Al Bureik tribe to take me with him.

I was very fortunate in this, for Bedouins as a rule are very reluctant to act as a foreigner's guide for the very simple reason that any Bedouin who accepts this position is held responsible to his tribe for the life of the foreigner, even to the sacrifice of his own life. I have no doubt that my guide, whose name was Salim, would have refused my offer at any other time of year. But on the eve of El Arafa, all the Bedouins are intent on reaching their homes as soon as possible in order to gain the festival which lasts two weeks. They have, therefore, no time for the raids, forays and holdups for which they are notorious.

My party left the last outpost of the Hadramaut on the 10th of March. Besides my guide, Salim, I was accompanied by Ali, a Somali negro whom I had hired as a servant, and a few other Bedouins. Dangling from our saddles were goat skin bags holding a six days' supply of water. We struck out across the desert whose nearest oasis was six days away. As we progressed farther into the desert the soft sand slowed the camels considerably. The trip was very exhausting. We had to ride on camel back from twelve to fourteen hours a day under a scorching sun, such distances being necessitated by the scattered feeding places for the camels. After many days we came within sight of the once glorious city of Shabwa, the capital of the kingdom of Sheba, which Pliny speaks of under the ancient name of Sabota.

Under cover of night

We pitched camp and held counsel to decide what strategic maneuvers would be necessary to gain admittance to the city. We knew that the inhabitants of the settlement that now stands on top of the ruins of the ancient capital would never allow a foreigner to enter their city. Poverty and superstition creates this hostile attitude. Accordingly we made up our minds to enter Shabwa sometime after midnight.

As the moon rose, I strolled away from the others and stood staring at the dim outline of the city against the desert sky. It seemed so calm and inviting in the soft light, not at all like a city whose superstitious and impoverished population looked upon all foreigners with hatred and fear, hating them as infidels and fearing that they would steal the hoard of gold and precious stones that their legends declare are buried somewhere in the ancient ruins.

As I gazed out across the expanse of pale sand, I saw Shabwa in terms of centuries. First as the capital city of the fabulously wealthy Queen of Sheba, one of a dynasty of thirty-three rulers, on through the time of Ethiopian ascendancy to its brief period under a Jewish king, and finally to the dissolution of the Sabean kingdom during the Islamic wars, and the gradual rise of the wild Bedouin tribes whose religious fervor has isolated Arabia from the rest of the world.

The riches of the Queen of Sheba, whose visit to King Solomon is recorded in the Bible, may have been exaggerated in the reports that have come down to us, but we may assume that she must have been a very important personage of her day. The country over which she ruled, Saba, held colonies in Africa and reached its peak in about the fifth century B. C.

At two in the morning we stole past the outer fortifications of the ancient capital, which stood gaunt and bare in the moonlight. No one blocked our path. Silently we crept along the empty streets, then through narrow passageways between the buildings. Suddenly Salim motioned for us to stop. From under his cloak he removed a curious wooden instrument. Then he signaled for us to follow him. He approached a building and inserted the curious wooden key beneath the ponderous beam that barred its door. The beam lifted, the door opened, and in a twinkling we were all inside. A narrow stairway led into the interior of the house and ended in a large room whose darkness was relieved only by an occasional moonbeam that filtered eerily through the narrow shooting-gaps in the wall. Exhausted, we dropped on the bare floor and fell asleep.

Early in the morning I was awakened by a bedlam of excited voices. I arose and rushed to one of the shooting-gaps. A group of camel riders were galloping headlong toward the house. They dismounted. There was a thunder of footsteps on the stairs. Was it an attack? No.

They were ten men of the tribe of Al Bureik who had been enlisted by one of our natives during our journey to join us with their support. Although they had come to our hiding place with the best intentions, their arrival in broad daylight only succeeded in arousing the inhabitants of Shabwa. While Ali was preparing a breakfast of coffee and rice for them, I left quietly with Salim and two other Bedouins to explore the city in the light of day. I brought along a still camera and a motion picture camera and was determined to get as many photographs of Sabean ruins as I could.

An ancient site

Shabwa is built upon three mounds, consisting largely of miscellaneous débris and heavy stone—all of which are covered over in many places with desert sand. Unfortunately for my purposes the present occupants of Shabwa had chosen to build their primitive clay houses on top of these three mounds which are so rich in the cultural remains of the Sabeans. Indeed many of the walls of their houses were partly made of fragmentary sections of ancient Sabean edifices.

Sixty temples are said to have existed in the "Sabatah Metropolis," or Sabota, of which Pliny, Ptolemy and Strabo speak. These temples are said to have been consecrated to the cult of the sun god, Sabis. Shabwa was the center of an important trade in spices. All the frankincense yielded by the plantations of the vicinity was sent to Shabwa where the priests levied a toll, then released for trade. Caravans carried it the entire length of the Arabian penisula, a 60 days' journey, even to Gaza in southern Palestine, where the costly product was traded to Greek and Roman merchants.

As I began my photographing, the ignorant and frightened inhabitants poured out of their homes and gathered around me. Unable to understand what I was doing, they became panic-stricken and began pelting me with stones and sand. Feverishly I searched for ancient inscriptions, photographing as fast as I could. I tried not to heed the shower of missiles that fell about me, for I was on the brink of achieving what I had so long sought. But my Bedouins had a more realistic grasp of the situation. They seized me by the arm and urged me to take to my heels, for the tumult in the city was spreading rapidly. As we started to run I saw a huge stone lavishly inscribed which was being used to bar the entrance to a goat stall. But there was no time to photograph it. A little farther on, in a depression between the mounds, I saw the ruins of a big building, possibly a royal palace, but my Bedouins forced me on. The city was in an uproar. Men had climbed the roofs of their homes and were shooting at us.

Flight

Completely out of breath, I reached the house where we had spent the night, only to find Ali and the friendly Bedouins dashing excitedly in all directions. From inside we could hear the crackle of rifle fire perilously close. Everyone wanted to take flight at once. In their haste the Bedouins pulled rifles from each other's hands, and amid the utter confusion Ali and I snatched up our belongings and ran to our camels. I could not distinguish friend from foe, because I had never seen some of the friendly Bedouins who had joined us that morning. Salim impressed upon them their responsibility for my safety. There seemed to be a score of snipers on every roof, but Salim and his Bedouins galloped about drawing most of the fire on themselves. I did not attempt to mount my camel but ran alongside him always careful to keep the beast between me and the gunfire. Ali did likewise. Such was our undignified departure from the city of Shabwa.

Once out of range we stopped and waited for our Bedouin companions. Presently they rejoined us and we started out together toward Irma, where we knew a more hospitable welcome awaited us.

After we had jogged along for some time, I became suddenly aware that our water supply was almost exhausted. Miles of burning desert and arid mountains lay before us. As we crossed the first of the two mountain passes that lay between us and Irma, our throats were as dry and hot as the sand underfoot. At noon we sought shelter from the rays of the sun under a ledge that jutted out from the side of a cliff. Here it was decided that the Bedouins should go on ahead to announce our arrival in Irma.

Off they went, while Ali, Salim and I rested a while before resuming our journey. We did not mind the loss of our comrades, for we felt there was little likelihood of our being pursued. Our path wound sinuously between the dark brown cliffs that rose on either side. Suddenly, there was the crack of a rifle. Then two more shots reverberated through the narrow ravine.

Salim shouted something at our unseen assailants. Their answer was another outburst of fire, and bullets ricocheted among the rocks nearby. We came to a stop in the middle of the path. Salim shouted to them that we were harmless travelers and begged them to come and ascertain the truth of his words. There was no answer, neither shots nor words. We advanced a few steps. Suddenly about 30 Bedouins stood in front of us—a sight that was far from comforting.

Taken captive

It was imperative to keep outwardly calm. I stood perfectly still, unhooked the nearly empty water bottle from my side and sipped it leisurely. The Bedouins advanced upon us. The first one, a young man who expressed ferocity in every line in his face, knelt in front of me and brought up his rifle in a position to shoot. I should undoubtedly have been a dead man had not one of his less bloodthirsty companions taken the rifle away from him. A third Bedouin walked up to me and gripped me by the throat. I did not move a muscle but, as if unaware of his existence, finished my water. My arms were seized and pinned behind me. Ali, too, was made prisoner.

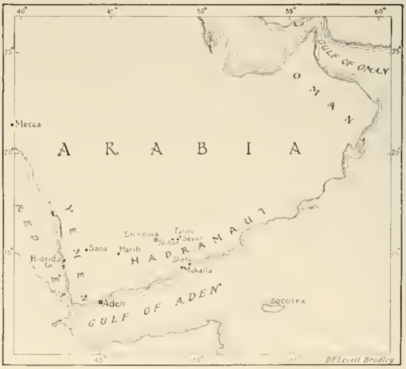
Our captors belonged to the tribe of El Atof, a group having no permanent residence. They were not participating in the religious festival and hence had not suspended their banditries. We were brought before their leader, Abdullah bin Abdullah. Salim tried to negotiate with him, but without success. Abdullah was quiet and dignified. He explained that the mountains belonged to his people and that under no conditions would we be permitted to cross them. Meanwhile, our baggage was being searched and the Bedouins were handing the cameras from one to the other. Then I suddenly had an idea.

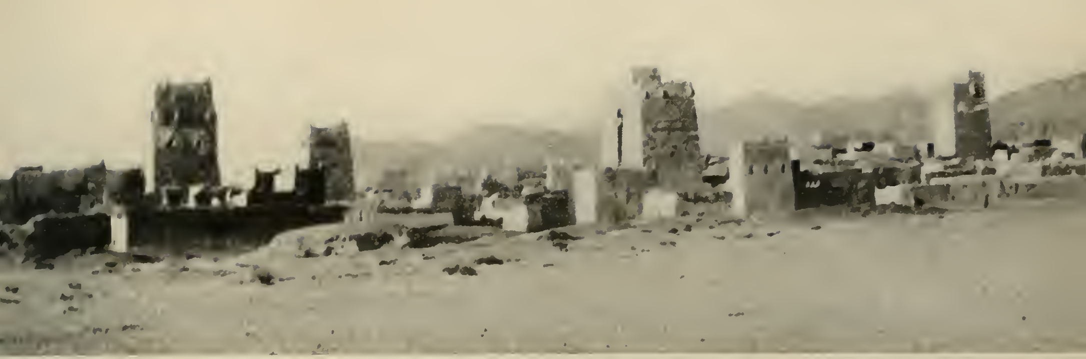
Through Salim as interpreter, I offered my assistance as Hakim (physician) telling Abdullah that I had many remedies in my luggage which might be of value if one of his tribe should be ill. The offer seemed to make a favorable impression, but nothing could be done unless we were prepared to pay a ransom. I had no money in my pockets, having left it all in Hadramaut so that it could not be stolen. For a solid hour, Salim and Abdullah haggled over the ransom. At last, Abdullah bin Abdullah agreed to the payment of ONE DOLLAR!

Freedom

The most important question having been settled, we went down the side of the mountain together and rested in the shade of a thorn tree. Presently I prepared to distribute my drugs and remedies. Almost at once, all of our captors became terribly ill. One of them complained of a headache, another had indigestion, and a few tried valiantly to simulate a cough. Nobody was left without medicine. I gave of my dispensary with a lavish hand. Finally we set off together—our erstwhile captors now taking the part of military escort. The rascal who had attacked me like a tiger, was the friendliest of them all. He sat behind me on my camel very proud to be allowed to ride with me. But at last we parted. The El Atof tribesmen returned to their mountain fastness, while Salim, Ali and myself continued on our way. That same evening we arrived safely at Irma.

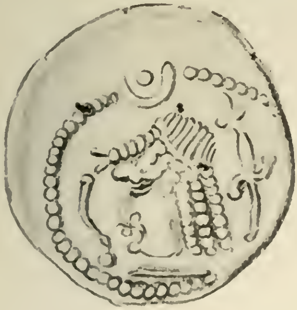
Unless the tribesmen of this inhospitable region change their attitude toward foreigners it will be a long time before the ruins of the traditional capital of Sheba can be scientifically excavated; but when they are, the relics that are unearthed may tell an interesting story of a land that has been famous in legend, lo! these many centuries.



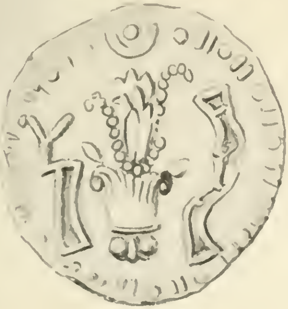


Skyscrapers of the Desert

The first visit of a white man to mysterious Shabwa, the legendary capital of the country of the Queen of Sheba



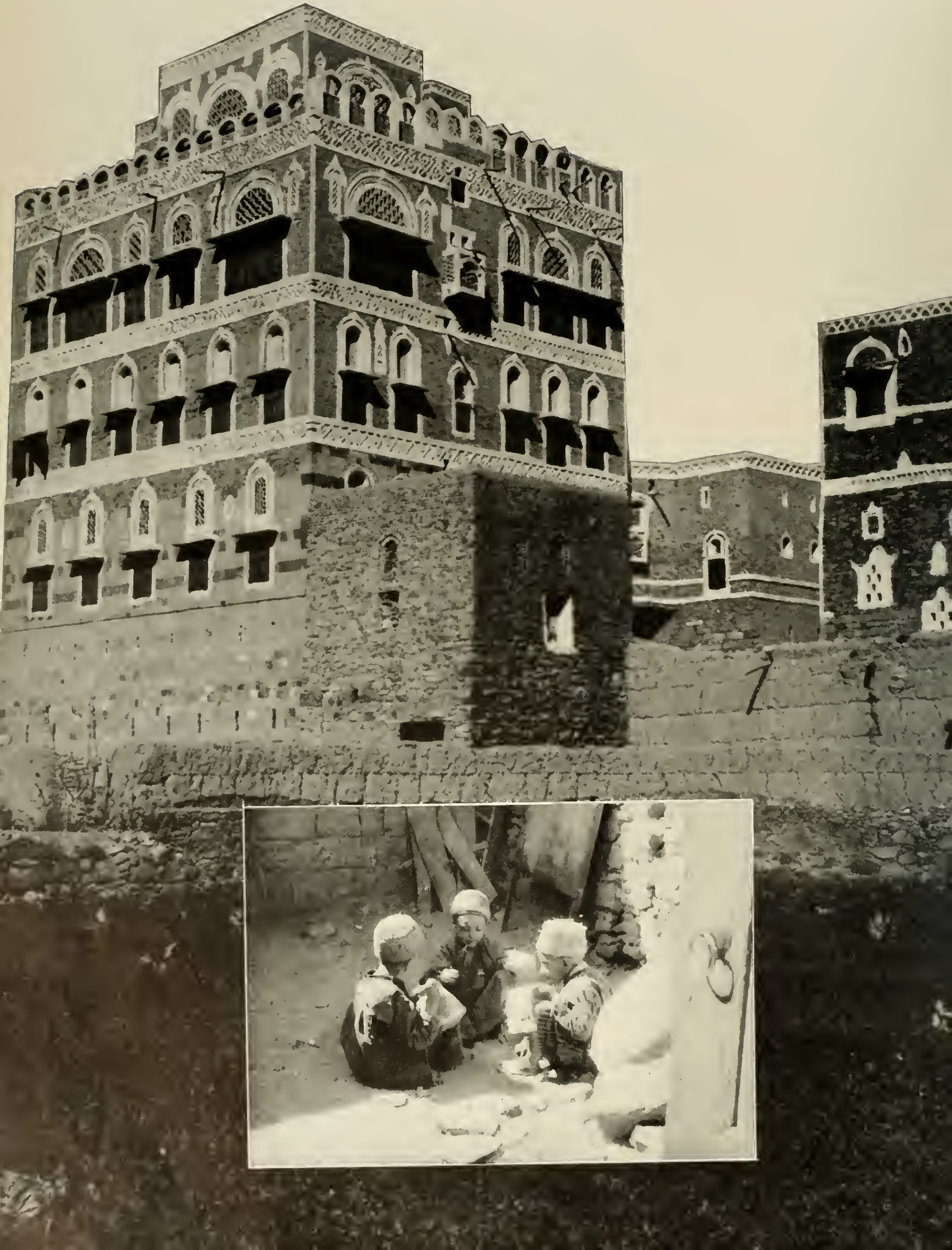
IN MYSTERIOUS SHABWA the explorer found natives carrying 2000-year-old coins as pocket pieces, like the one illustrated here. It bears Sabean characters, but ancient Greek motif



(Above) PRISON TOWN: Harib in innermost Yemen, where the explorer Hans Helfritz was thrown behind bars on his second expedition into Southern Arabia. After three weeks' imprisonment he was deported

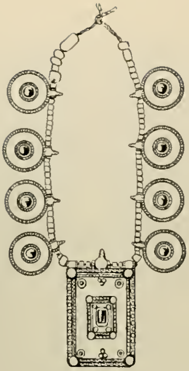
(Below) IN ARAB DRESS: the explorer whose recent trip took him through sections of Arabia never before visited by a white man

(Below) ARAB MERCHANTS bargaining with Bedouins in southwestern Arabia, where Maria Theresa dollars are used



SANA, the Capital of Yemen, to which Mr. Helfritz was deported on his second unsuccessful expedition to reach the heart of the ancient Sabean kingdom, the Biblical *Sheba.* The building shown is decorated with plastic lime ornamentation and has windows of thinnest alabaster

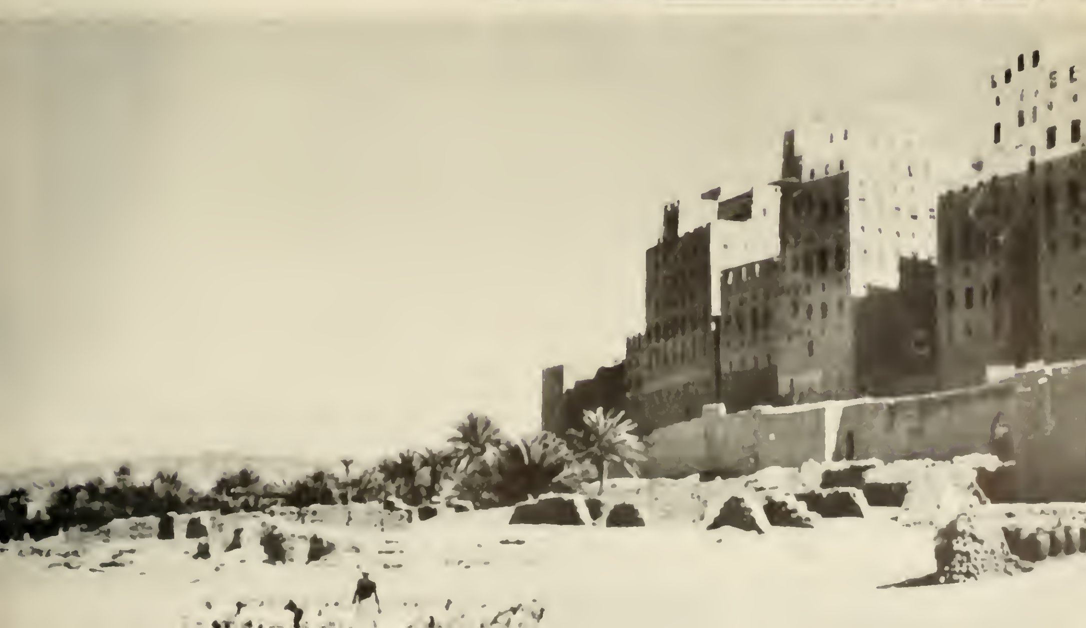
(Below) ARAB BOYS in Sana learning their school lesson

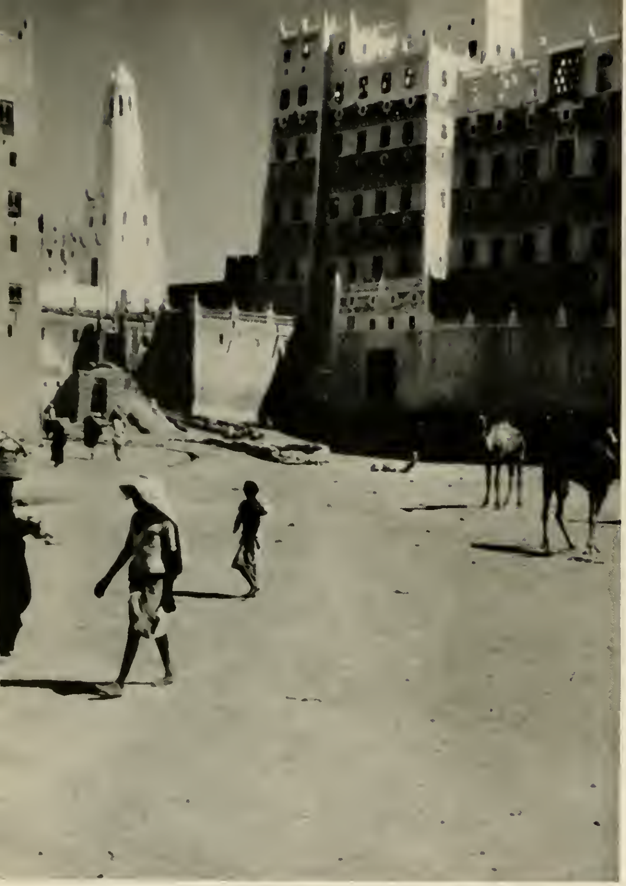


(Above) A SILVER AND CORAL NECKLACE set with rubies

(Right) BEDOUIN MOTHER AND CHILD in Lower Yemen, a region noted for its extreme heat

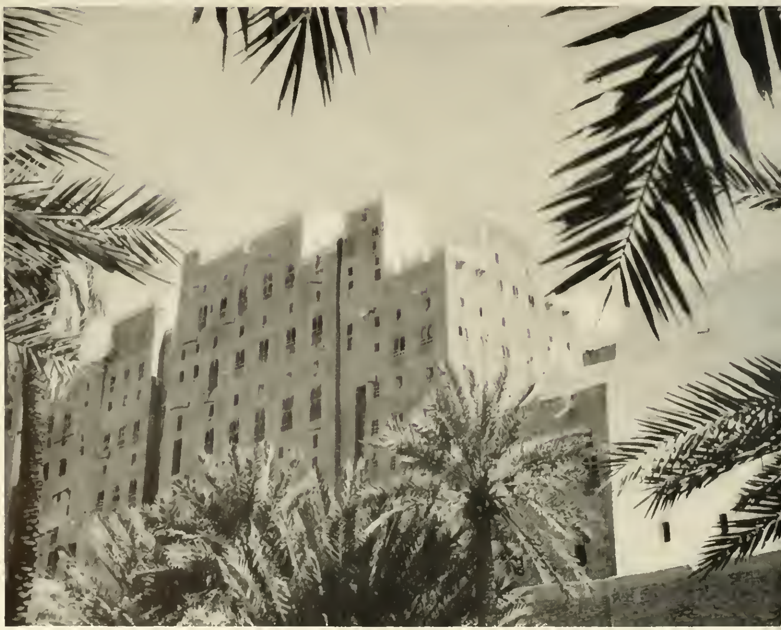
(Below) ARABIAN SKYSCRAPERS: The ancient city of Shibam, in Hadramaut, the province through which the explorer passed on his several expeditions. Like the apartment buildings of a modern metropolis, the mud dwellings rise to a height of 100 feet, with 11 stories. The houses are built so close together that they take the place of an encircling wall in a region where the various tribes are constantly at war

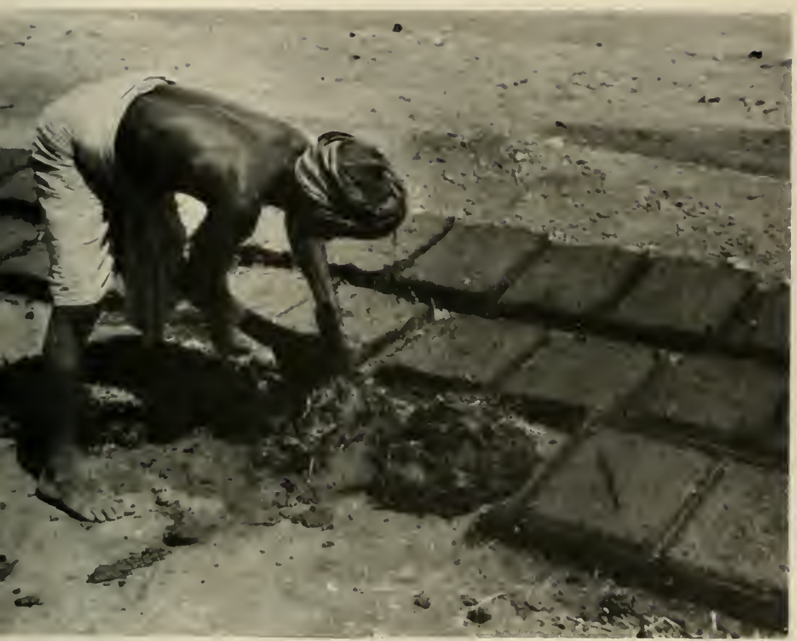




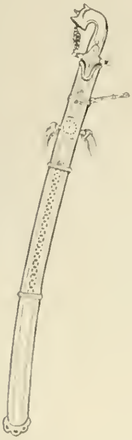
(Left) THE PALACE OF THE SULTAN OF SHIBAM, a Mohammedan ruler in a country that clings to the ways of the Middle Ages. Sewage flows in wooden pipes through the streets

(Below) DATING FROM A TIME when the colonization of America had just begun, these Arabian skyscrapers, built without plans of any sort, possess a purity of line that is astonishing

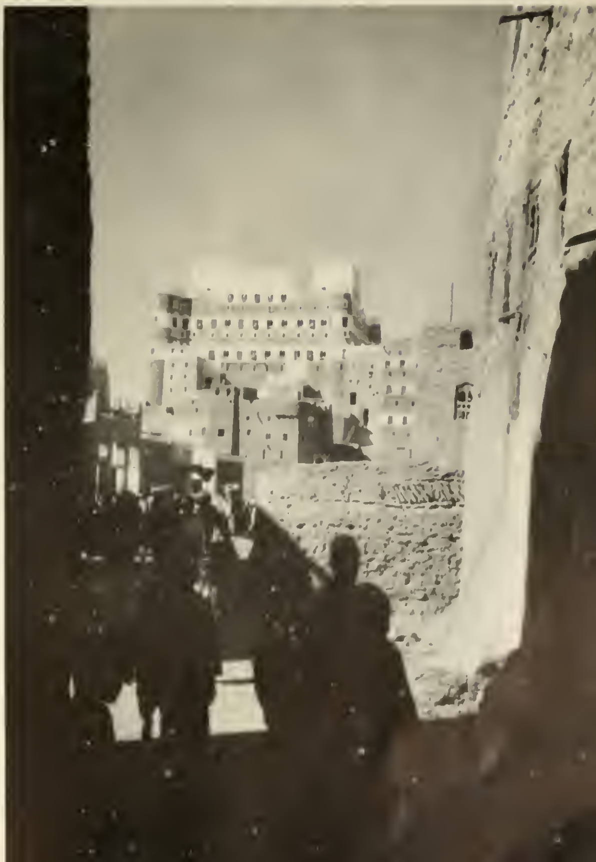




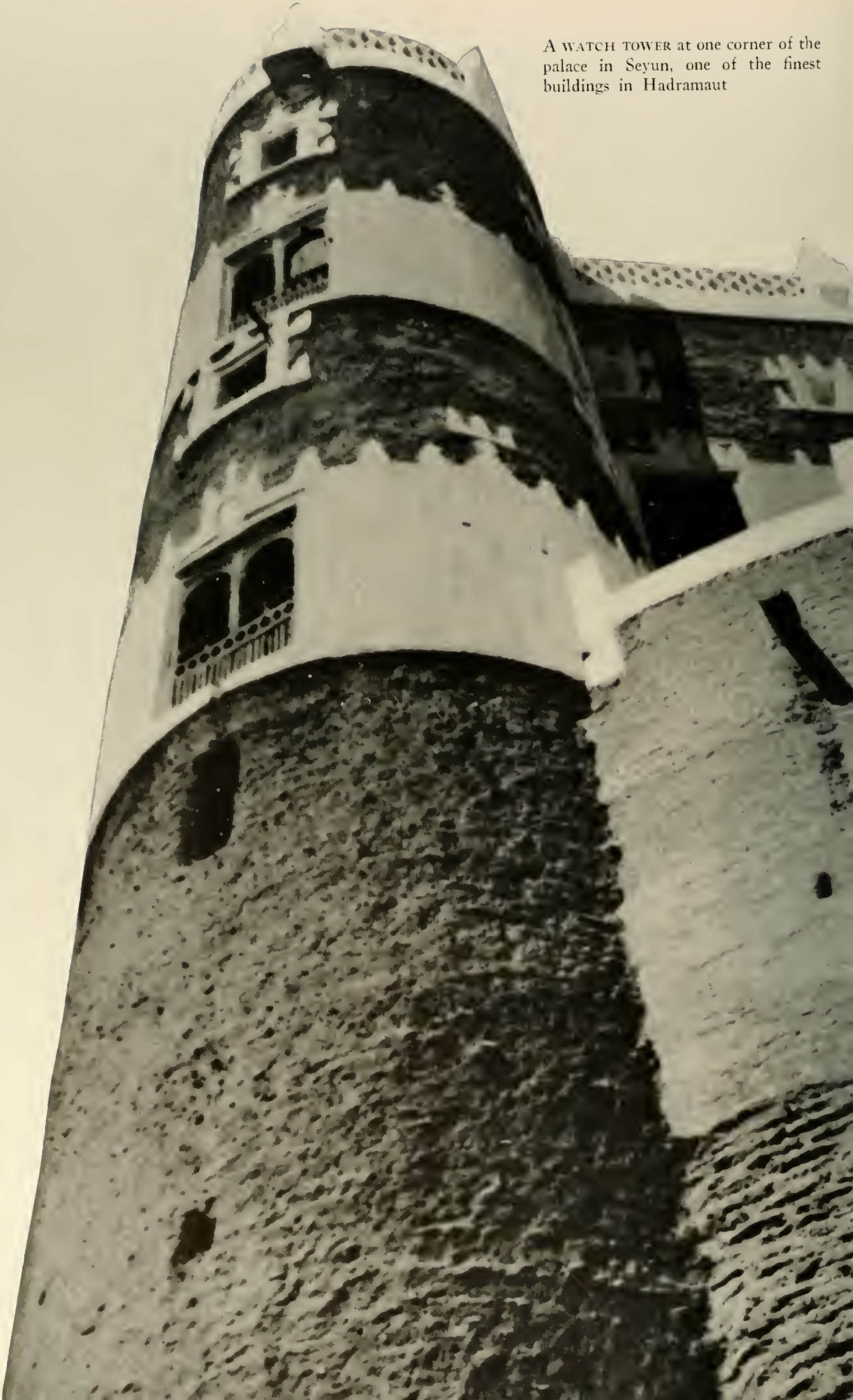
(Above) Sun-dried brick is the universal building material. The clay is mixed with water and cut straw according to the ancient formula



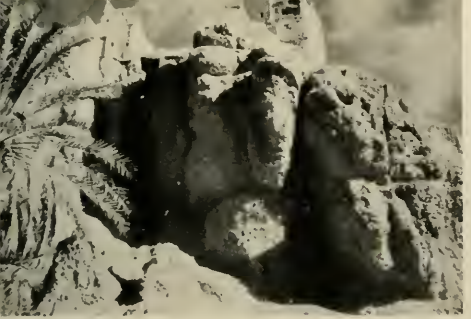
(Above) Ornamental sword in silver scabbard, used only by chiefs and sultans

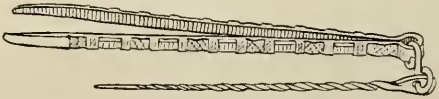


(Right) Palace of the Sultan of Seyun, where Mr. Helfritz, with the assistance of the royal family Al Kaff, persuaded a Bedouin to act as his guide over the route to Shabwa which had so long frustrated him



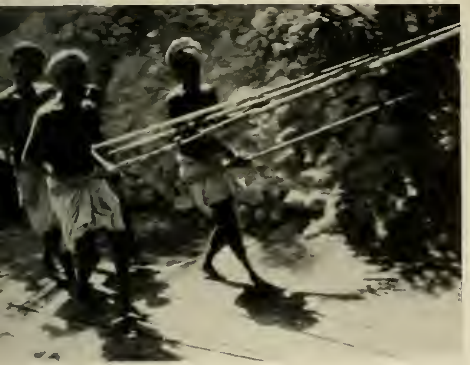
A WATCH TOWER at one corner of the palace in Seyun, one of the finest buildings in Hadramaut





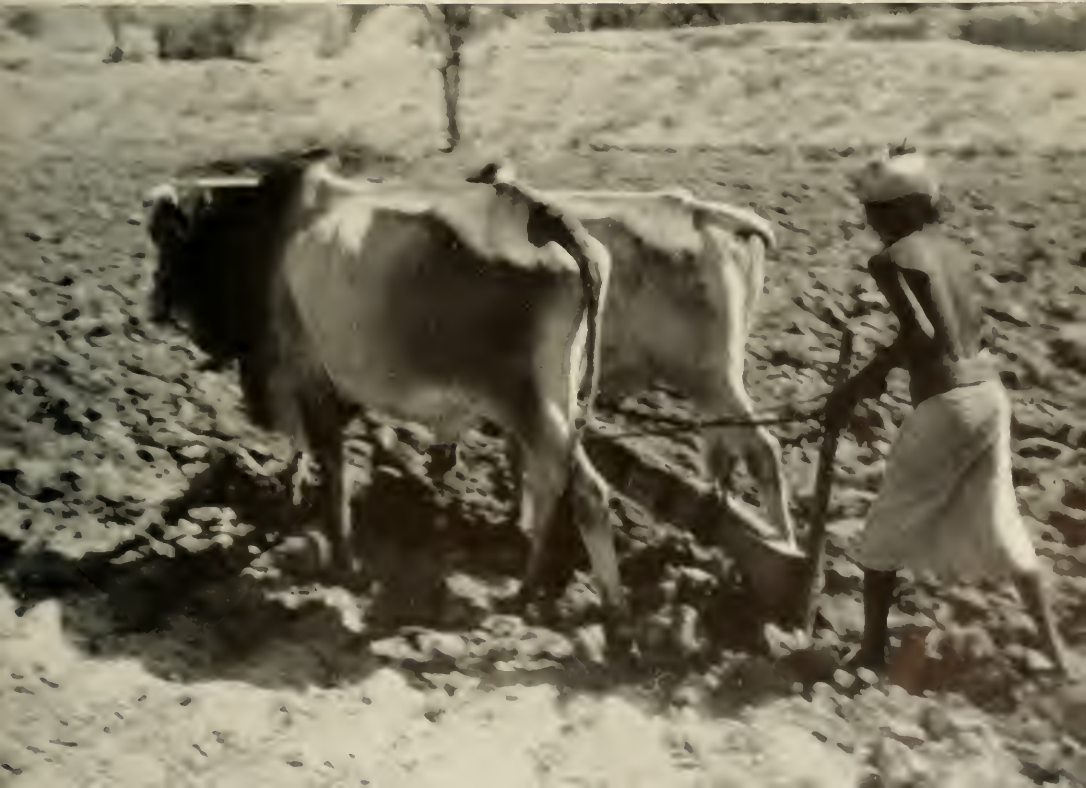
(Above) Brass thorn- and whisker-remover; also used for arranging charcoal in water pipe

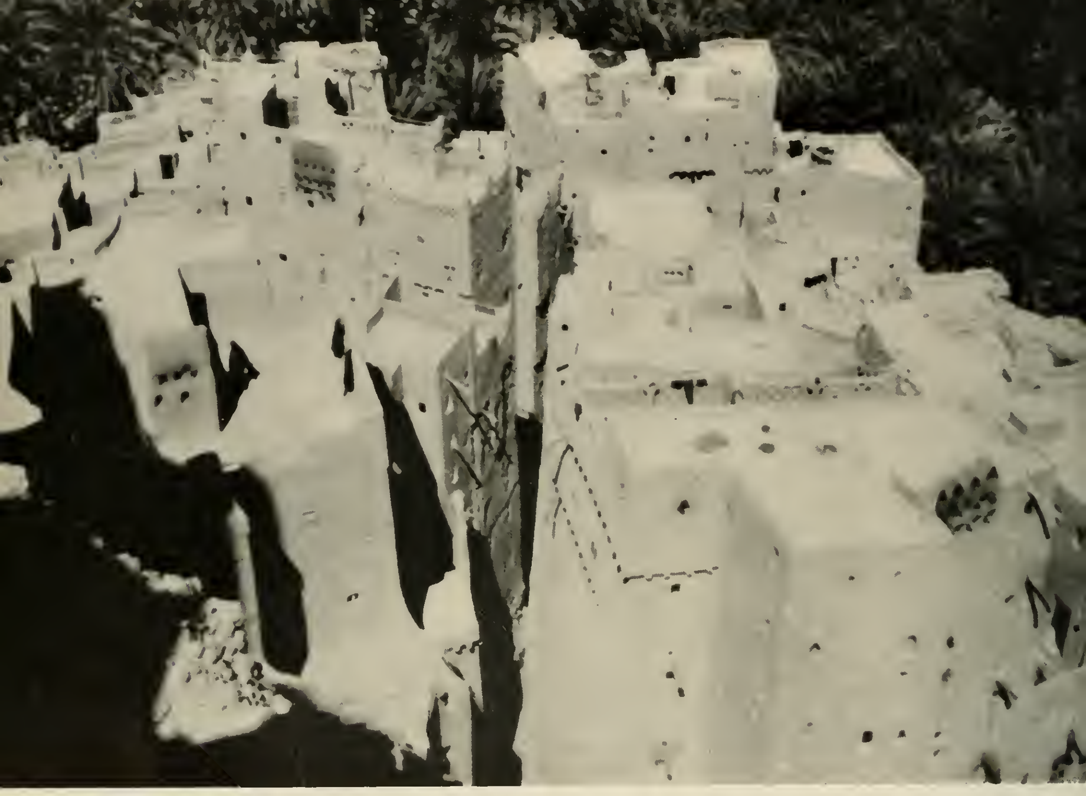
(Left, above) A small fortified village, Hadjaren, which was in a Bedouin war zone when the explorer passed through



(Left) Water for irrigation is the life-blood of the region. By man-power large leather bags are hoisted from deep wells and poured into small channels leading into the fields

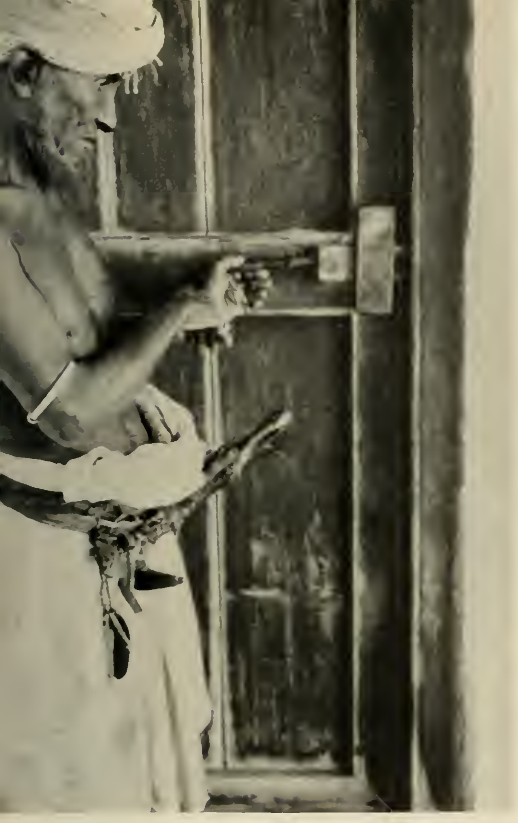
(Below) Wooden ploughshares are used in this antiquated region





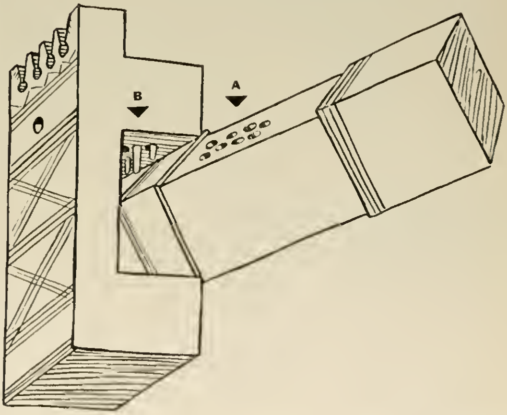
(Above) THE COMPACT TOWN of Ourah in the most fertile district of Hadramaut is surrounded by date plantations

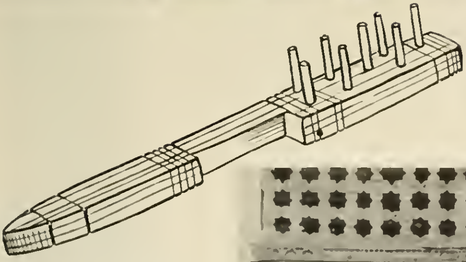
(Below) FEEDING THE CAMELS: A Bedouin apportioning the small dried fish which were carried by the caravan to nourish "the ships of the desert" on the dangerous journey to Shabwa



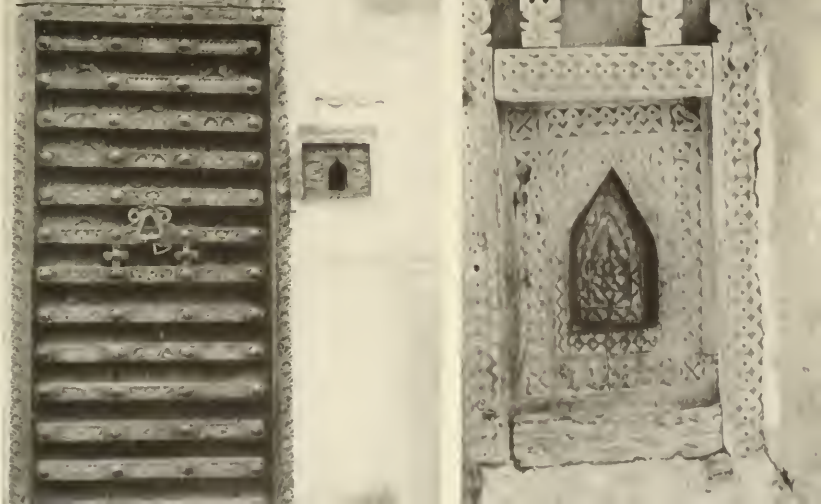
(Left) OPENING THE DOOR of an Arab house. Although their locks and keys are of wood, the natives of southwestern Arabia have applied the same principle that is used in our modern steel locks

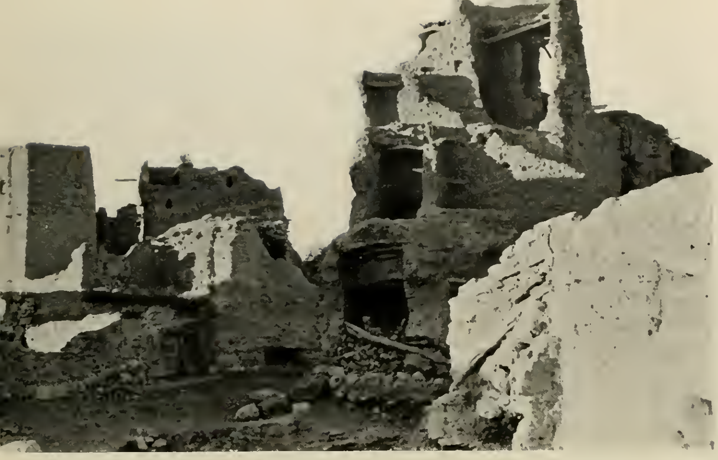
(Below) THE KEY AND THE LOCK. The key is not turned in the lock, but lifted, causing the wooden pegs projecting from it, which exactly fit the holes in the bolt at A, to raise the pins, B, allowing the bolt to be slid open

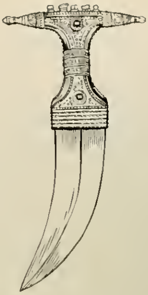




(Right) A BEAUTIFULLY CARVED DOOR characteristic of the architecture of southwestern Arabia. Note the ornamental keyhole at the side. At right: keyhole enlarged

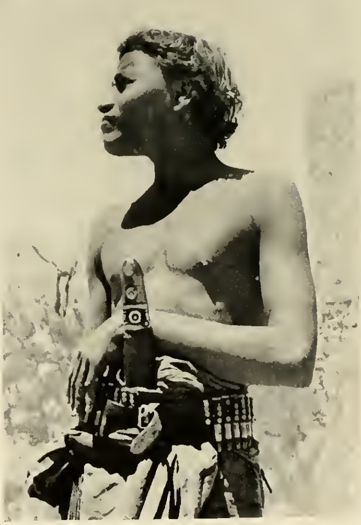






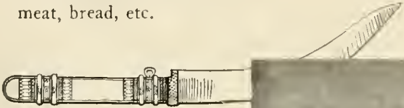
(Above) A Dagger used for fighting

(Above) Shabwa, the legendary capital of the realm of the Queen of Sheba, which Mr. Helfritz was the first European to enter. The modern town is built on three mounds, which are believed to be rich in cultural remains of the ancient Sabeans

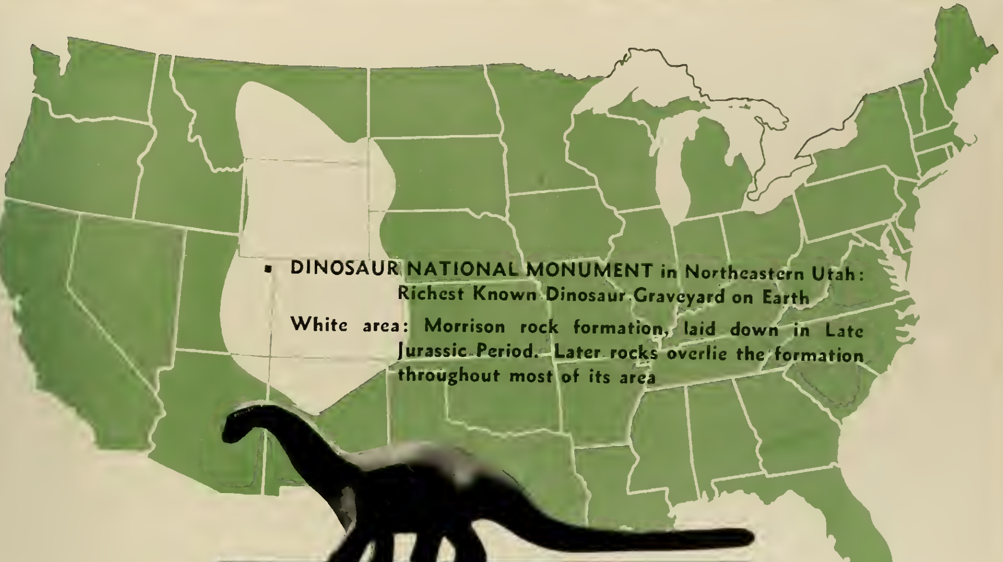


(Right) A Bedouin from Shabwa with customary armament

(Below) A small knife used for cutting meat, bread, etc.



Several hours after entering Shabwa the explorer was forced to flee under fire from the inhabitants, who regard all foreigners with hatred and fear. Shabwa, the mythical capital of Sheba, remains an archaeological mystery



▪ **DINOSAUR NATIONAL MONUMENT in Northeastern Utah: Richest Known Dinosaur Graveyard on Earth**

White area: Morrison rock formation, laid down in Late Jurassic Period. Later rocks overlie the formation throughout most of its area

A TABLEAU OF PREHISTORIC
ANIMALS IN THE LIVING ROCK
WHERE NATURE BURIED THEM
140 MILLION YEARS AGO

DINOSAURS
ON PARADE

By BARNUM BROWN

Curator of Fossil Reptiles
American Museum of Natural History

COMPARATIVELY few people have ever heard of the Dinosaur National Monument, in northeastern Utah; yet when completed it will exhibit to tourists and students the most remarkable accumulation of dinosaur remains ever discovered. Here one will see a veritable Noah's Ark of extinct animals from the hey-day of dinosaurian life.

Approaching the Monument from Salt Lake City, the speedometer reads 228 miles as you cross the bridge over the Green River, where a spur road leads six miles northward to the Monument. The same highway, Route 40, continues eastward to Denver, Colorado, about three hundred miles distant.

The geology of the region is extremely interesting and the scenery spectacular. From the air you look down into the deep, fearsome gorge of Ladore Canyon, between whose abrupt shelving walls the mighty Green River has for eons of time torn its way. First buffeting against one wall, then rebounding to the other, the river finally forces its course through a narrow cleft in the limestone walls out into the quieter valleys of the open country.

From a distance Green River appears to come right out of the base of Split Mountain just south of which lies the Monument. Split Mountain is a lesser peak in the eastern extension of the Uinta Mountain Range, rising to an elevation of 8000 feet above sea level and several hundred feet above the River. On the west its bare crown of Carboniferous limestone rises like the bottom of an inverted bowl, while on the south, the skyline presents a picturesque jagged outline.

History book in rock

Here at the base of Split Mountain on its southern flank the upturned edges of softer sedimentary rocks stand on edge, layer after layer. One is reminded of the deckle-edged pages of an open book as he looks down upon the eroded leaves of rock. and a book they are indeed, for they contain more than fifty million years of the earth's history, notably that period of the Age of Reptiles known as the Jurassic. So clear is the story and so filled are the pages with documented evidence that one does not need to be a geologist to read it. As though to make the interpretation easier, the various layers of sandstone, clays and shales are delicately colored in pastel shades ranging from blues to brilliant red. For the most part each shade is continuous, identifying the rocks of each geological age and extending around the mountain base like brilliant ribbons.

In these layers there are beds of shells, some of them shallow water forms, others from the deep; while elsewhere the rocks contain millions of fish scales and fish bones. In some places there are long walls of ripple-marked sandstones that once marked the shore of an ancient sea, and here one's imagination is occasionally stirred by the sight of foot-prints of a three-toed dinosaur which millions of years ago roamed the land.

It is chiefly the skeletal remains of the many varieties of dinosaurs, caught in death and preserved, that will appeal to the interest of the tourist who will visit the completed Monument. The bones are unusually well preserved. There are skeletons of the largest of the sauropod dinosaurs mingled with those of powerful but smaller flesh-eating forms. The heavily armored forms like Stegosaurus are represented, as well as the smaller bird-like dinosaurs; and intermingled with these are an occasional turtle shell, crocodile remains, fresh water shells, Cycads, fossil leaves, worm trails and wood fragments. Specimens already removed represent eleven genera of dinosaurs, and we have reason to believe that others will be discovered.

One at first wonders how so many animals could have found their resting place in one spot. Reconstructing the history from a study of the sediments one concludes that the creatures must have perished over a considerable area, drifting here from many points upstream during freshets, and were deposited in shallow water along a series of old river bars where the current was retarded. Thus were brought together the animals and a partial flora of an entire region. This greatly enhances the interest of the site, for the casual visitor is able to see most of the better known Jurassic dinosaurs in one aggregation. In some places the "bone pile" was five feet thick, crossed and criss-crossed with partial skeletons sometimes extending into the mass and therefore presenting difficult problems to the excavator.

The Monument, known as "Dinosaur" to the Park Service, is the fruition of years of work and is still partly in the blue-print stage.

Discovery

In 1909, Dr. Earl Douglas of the Carnegie Museum, never dreaming of the extent of the treasure that lay beneath his excavating pick, dug where the tail of a prehistoric reptile projected from the rock and uncovered this Eldorado of vanished animals. It was the richest deposit of its kind that had ever been discovered, and nothing to surpass it has ever been found since.

The first specimen he removed was a gigantic sauropod dinosaur *Apatosaurus* (*Brontosaurus*), 75 feet long. This skeleton, which was almost complete, was subsequently mounted in the Carnegie Museum. In excavating it other specimens were uncovered and thus the work was continued by the Carnegie Museum for thirteen years, during which time seven carloads of bones were removed.

President Wilson in 1915 set aside an area of eighty acres embracing the quarry, to be known as Dinosaur National Monument, and placed it under the jurisdiction of the National Park Service. But up to the present, the site has been a monument in name only, as practically all visible specimens have been removed by the Carnegie Museum, the National Museum, and the University of Utah, all of which have at some time worked the quarry.

It is natural that with several institutions digging at various times in the same intermingled bone pile, it has not always been easy to keep the skeletons separate. The remains of one very exceptional dinosaur thus suffered a curious fate. The National Museum removed its neck, then the University of Utah obtained permission to work in the quarry and removed the body of the same creature but found that a part of the tail had previously been taken out by the Carnegie Museum during earlier operations. Parts of this one individual were thus distributed among three institutions. The creature seemed destined to pass the remainder of its existence dismembered, for no agreement could be reached on an exchange basis by which one institution would secure all of the animal. Finally the American Museum bartered for the different sections of the skeleton and eventually procured all of it. This animal, which will eventually be mounted in the American Museum, is one of the largest and rarest of the large sauropod dinosaurs, *Barosaurus*. The skeleton of this gigantic creature is approximately 80 feet long and will stand about 15 feet high at the hips.

Nature's prehistoric mural

The American Museum became interested in the Dinosaur National Monument project in 1931, and since then I have directed the general development. The major feature of the exhibit will be a huge display of the skeletons in position in the cliff, which will form the north wall of the 190-foot building sheltering them. These skeletons occupy the central block of the cliff, and although they have not yet been uncovered, are known to exist because above and on either side for a total distance of 400 feet, excavations have proved that the deposit is continuous.

The dinosaur skeletons will be worked out in relief just where nature left them. Separate bones and fragmentary material will be removed, leaving nothing to distract the eye from the connected skeletons; and spotlights will accentuate the details in each skeleton in bas relief. The spacious building to be erected will house other exhibits. In the center of the room will stand lifelike models, made to scale, of each of the animals whose skeletons are seen on the north wall. On the south wall of the building will be placed a gigantic mural 190 feet long and 20 feet high showing the animals as they looked in life 140 million years ago, amidst the vegetation and landscape that then existed.

The work is cooperative among the National Park Service, the American Museum, and the State of Utah, and divided as follows: First, a huge cut exposing the bone layer is the work of the National Park Service, which fortunately has been able to employ Emergency Workers, who to the number of 50 to 100 men have been engaged during the past three years. At present, the cut is three-fourths completed.

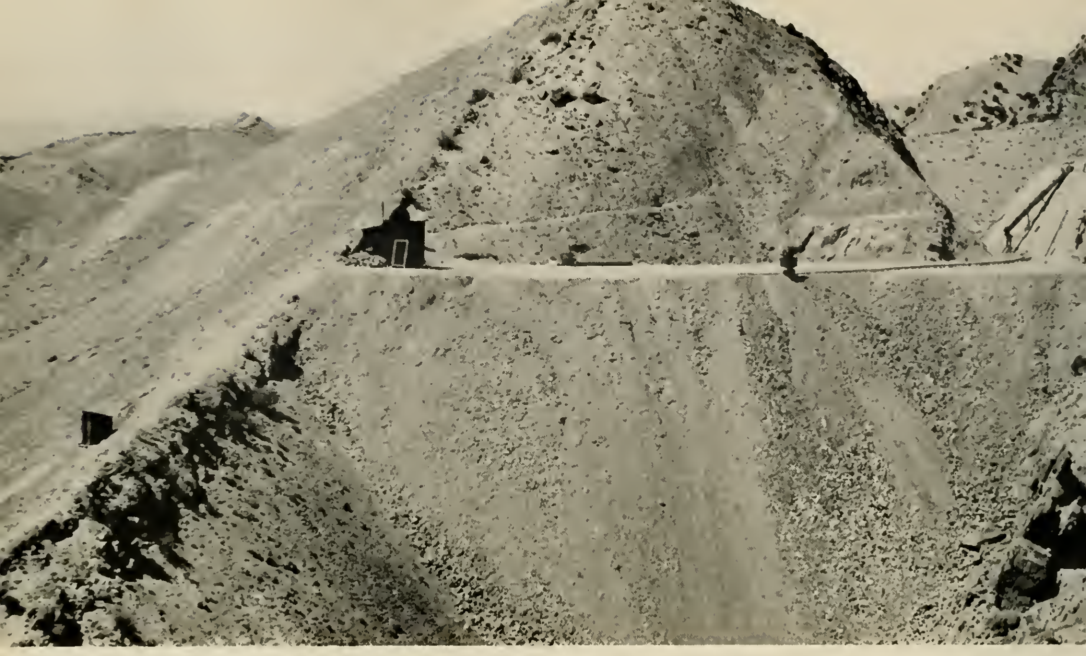
When the excavation is finished, the American Museum is to put in a corps of trained technical men, who will use compressed air drills and later more delicate tools to work the skeletons into relief, and will preserve them against deterioration. This part of the work is a slow and painstaking procedure that can be handled only by Museum-trained men, and it is estimated to require two and one-half years. The result will be a portrayal such as exists nowhere else in the world, showing not only an incomparable collection of prehistoric animal remains but also the problems of the scientific excavator in reconstructing the life of a vanished age.

A preëminent educational feature

The National Park Service will erect the Museum Building housing the exhibit, also the houses for custodians, the water supply and general improvements, and a huge parking space for the accommodation of the auto-touring public.

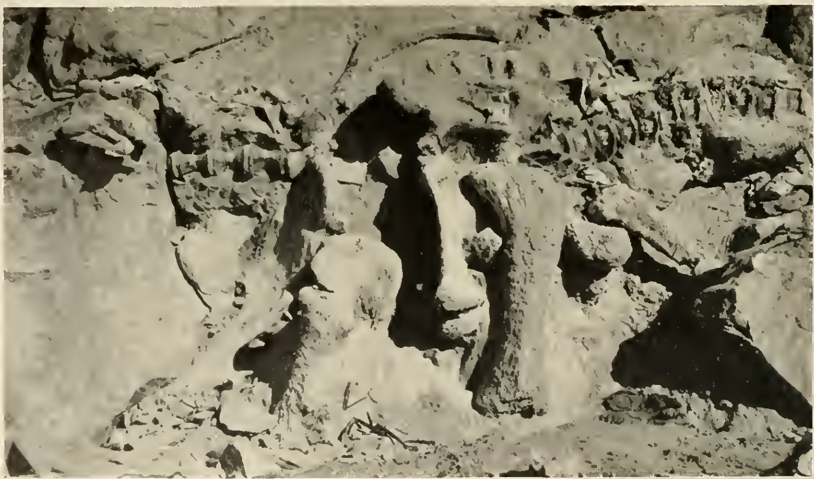
The State of Utah has increased the original area of eighty acres by giving twelve sections of land surrounding it which take in most of the adjacent spectacular scenery. The State will also construct a road connecting Highway 40 at the little town of Jansen with the Monument.

The Dinosaur National Monument, when completed sometime within the next three years, will be unique in character and is destined to become the crowning educational jewel of our entire system of national parks. It is the greatest natural history feature ever attempted and is an achievement of such magnitude that it will rank with the great monuments of the world.



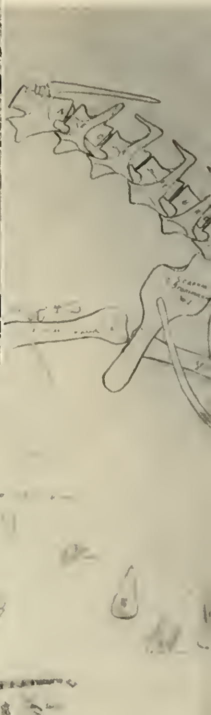
Brown, Bird P

(Above) THE RICH DINOSAUR BEDS which form the central feature of Dinosaur National Monument lie behind the chute erected in the cut. This face of rock corresponds to the sloping wall in the diagram opposite

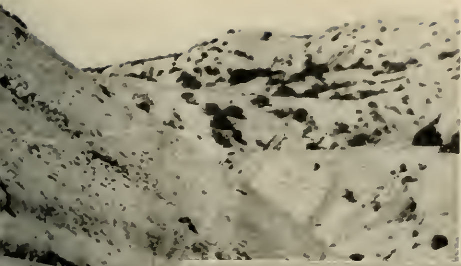


University of Utah Photograph

(Above) SKELETON OF A SAUROPOD DINOSAUR in bas relief. In similar fashion the innumerable bodies as yet uncovered will be left half exposed in the completed exhibition building. All fragmentary material will be removed and spotlights will accentuate the connected skeletons



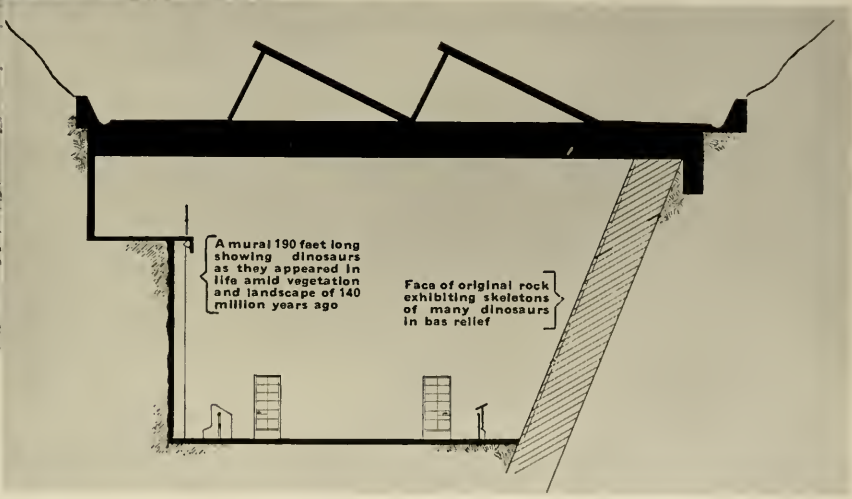
(Right) CHART OF SKELETONS in a section of the dinosaur quarry excavated by the Carnegie Museum. A complete diagram will be made of the entire bone-bearing wall for identifying fragmentary material that has to be removed



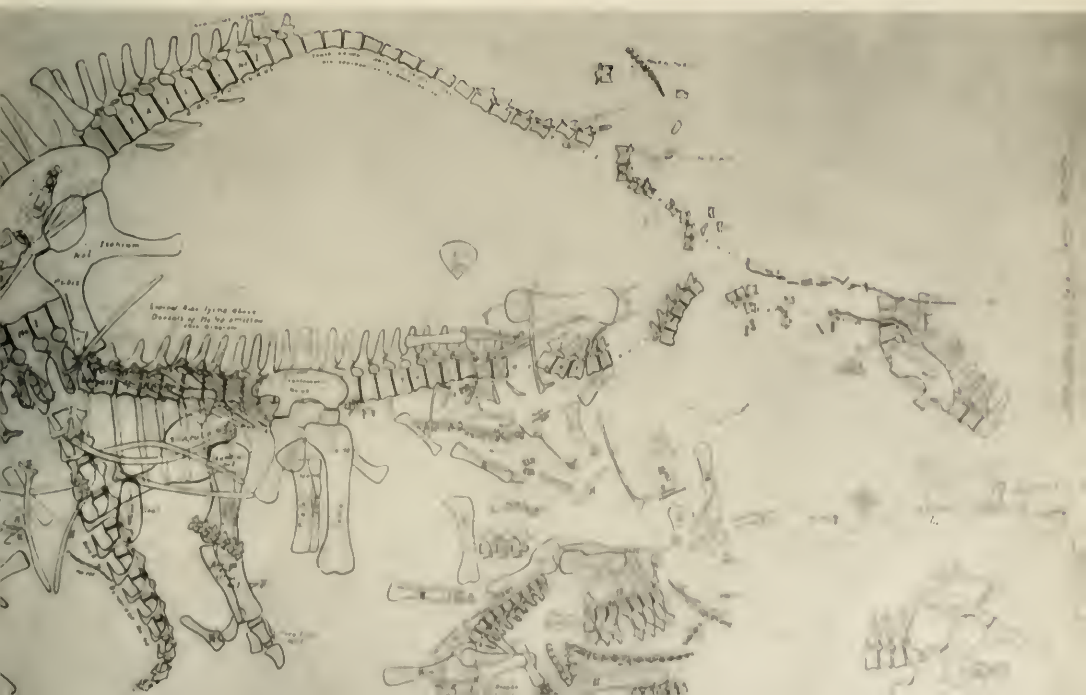
(Left) WHERE A VERITABLE NOAH'S ARK of prehistoric animals will be exhibited to tourists and students: the richest known dinosaur graveyard on earth. Dinosaur National Monument, Utah

(Below) PLAN OF BUILDING to shelter the exhibit. The dinosaur remains will be left half exposed in the living rock where Nature buried them. Scale models and a gigantic wall painting will depict the animals as they appeared in life. The spectacle will have no equal anywhere in the world

Drawing by Robert S. Russell


A mural 190 feet long showing dinosaurs as they appeared in life amid vegetation and landscape of 140 million years ago
Face of original rock exhibiting skeletons of many dinosaurs in bas relief

Carnegie Museum Photogr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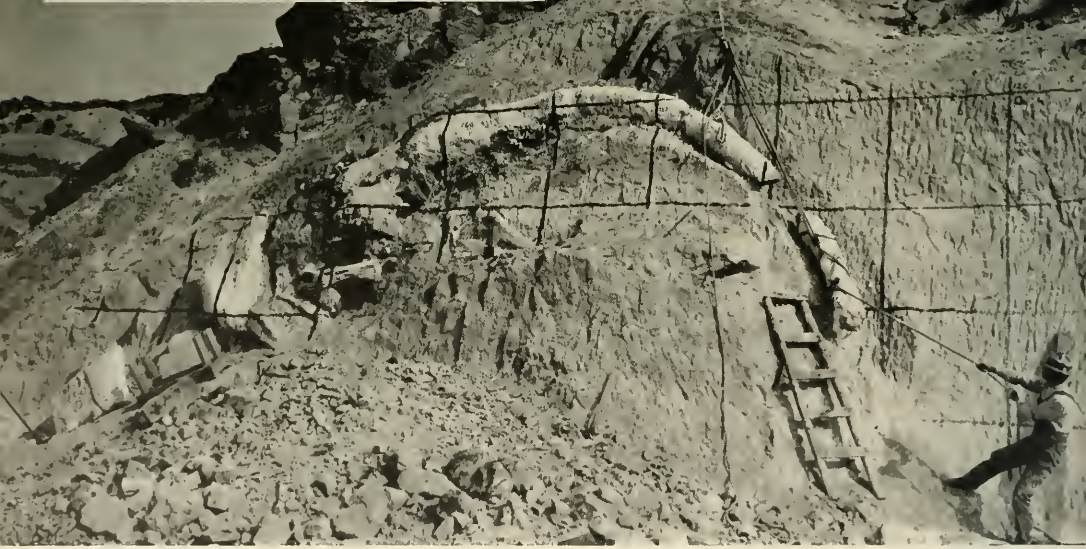
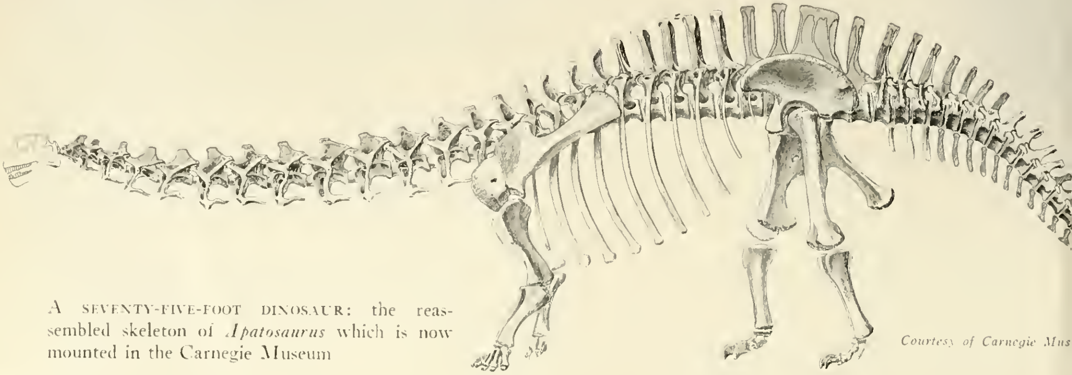
THREE STAGES IN THE DISCOVERY OF A DINOSAUR. It was the tail bones shown at left which Dr. Carl Douglas of the Carnegie Museum first uncovered in 1909 when he unsuspectingly discovered this Eldorado of vanished animals, the richest deposit of its kind in the world. The bones proved on further excavation to belong to the gigantic *Apatosaurus (Brontosaurus)* shown below, where plaster jackets have been applied in preparation for removal.

Carnegie Museum Photographs

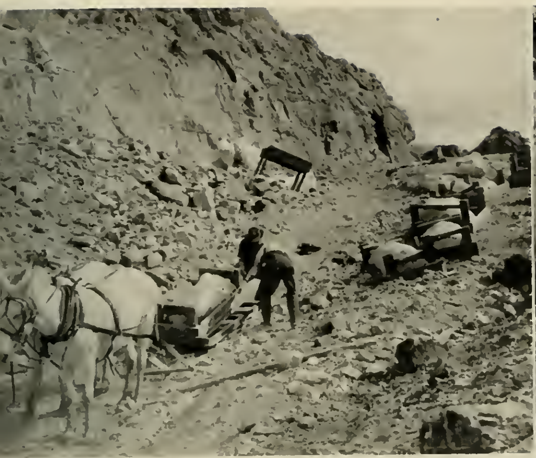


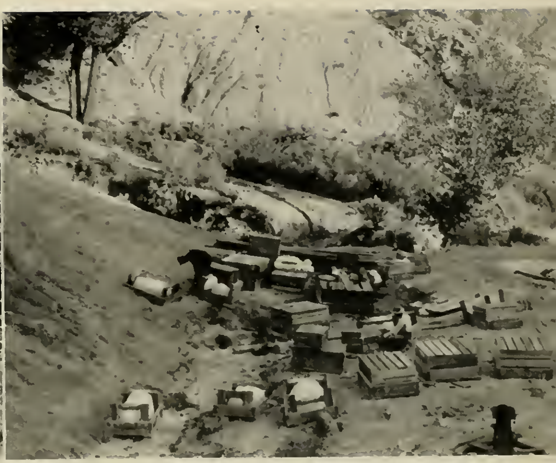
AT THE STAGE SHOWN ABOVE, the skeletons that are to be exhibited at Dinosaur National Monument will be left imbedded in the rock and covered with a protective varnish



A SEVENTY-FIVE-FOOT DINOSAUR: the reassembled skeleton of *Apatosaurus* which is now mounted in the Carnegie Museum

Courtesy of Carnegie Mus





Carnegie Museum Photographs

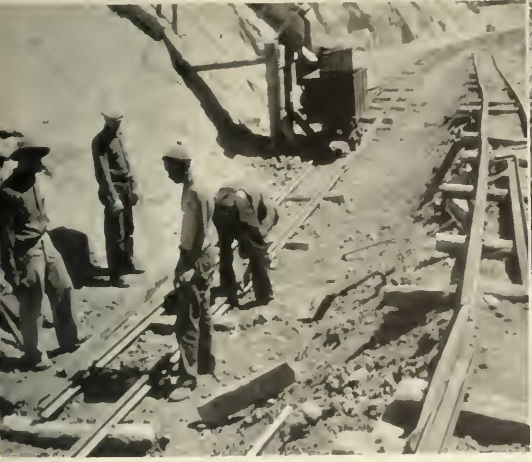
An early photograph of the dinosaur quarry. Blocks of specimens are shown encased in plaster jackets for removal on stone boats drawn by horses

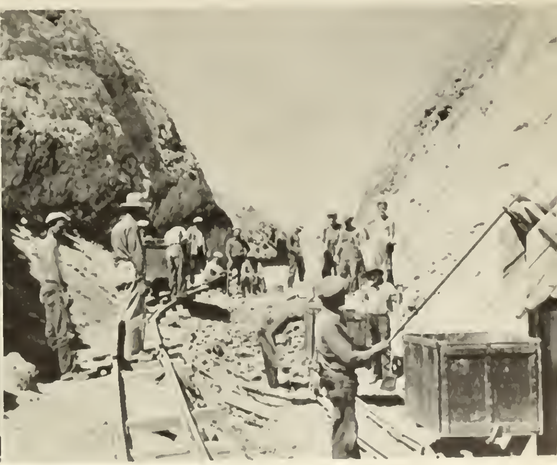
Crating was completed west of the quarry, where material was loaded into wagons and hauled approximately 120 miles to the railroad at Price, Utah

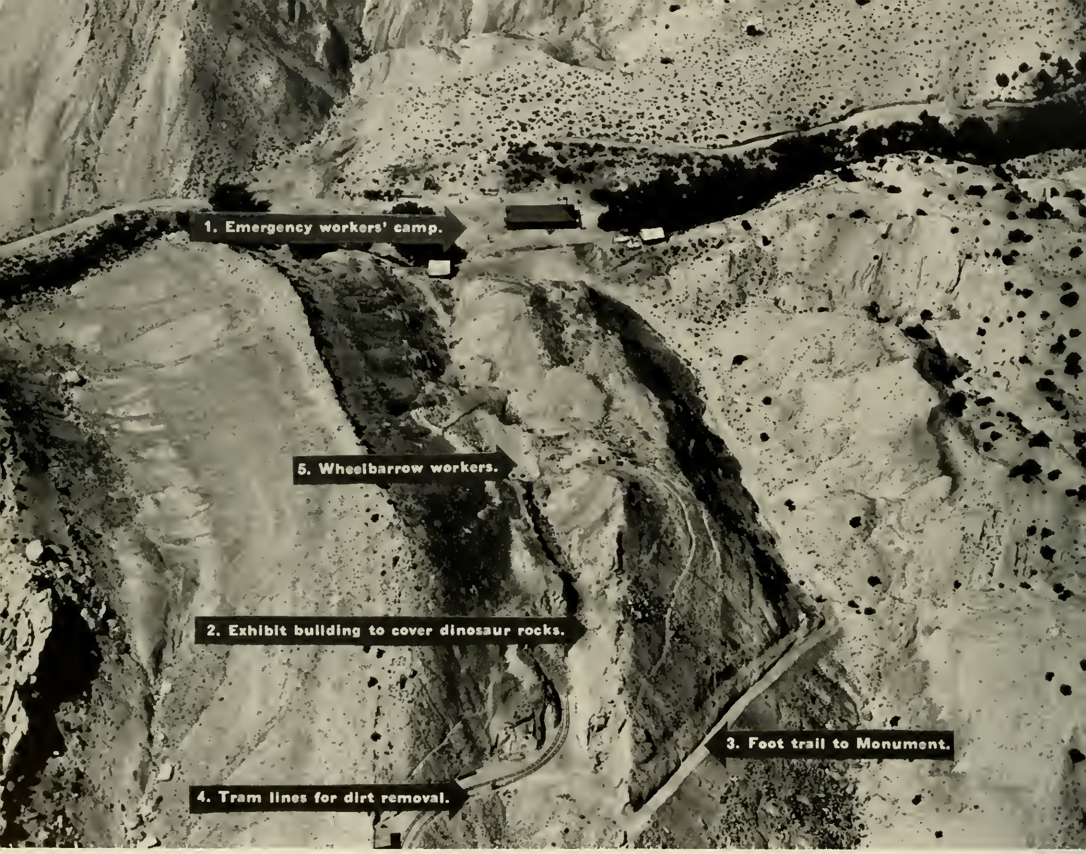
Modern methods employ tram lines and compressed air drills. The photograph below shows Emergency workers enlarging the cut and removing surplus rock covering the bone-bearing layer. From 50 to 100 Emergency workers have been engaged during the last three years

The chute at right facilitates the removal of rock covering bone layer. When the rough work is completed, the American Museum of Natural History will put in a corps of trained technicians to work the skeletons into relief and preserve them against deterioration

Photographs by Dr. A. C. Boyle, Jr.






1. Emergency workers' camp.
5. Wheelbarrow workers.
2. Exhibit building to cover dinosaur rocks.
3. Foot trail to Monument.
4. Tram lines for dirt removal.

Brown Aerial Photograph

DINOSAUR NATIONAL MONUMENT SITE: Aerial photograph from 3,000 feet showing progress of work in September, 1934. Improvements will include a huge parking space for the public, a water supply system, and houses for custodians

(Below) ARROW MARKS POSITION of Dinosaur National Monument beyond Green River on first photograph ever taken of the region. The approach is made through spectacular scenery over a spur road branching off from Route 40, 228 miles east of Salt Lake City. The State of Utah has increased the original 80 acres comprising the Monument by giving 12 sections of surrounding land

Carnegie Museum Photograph

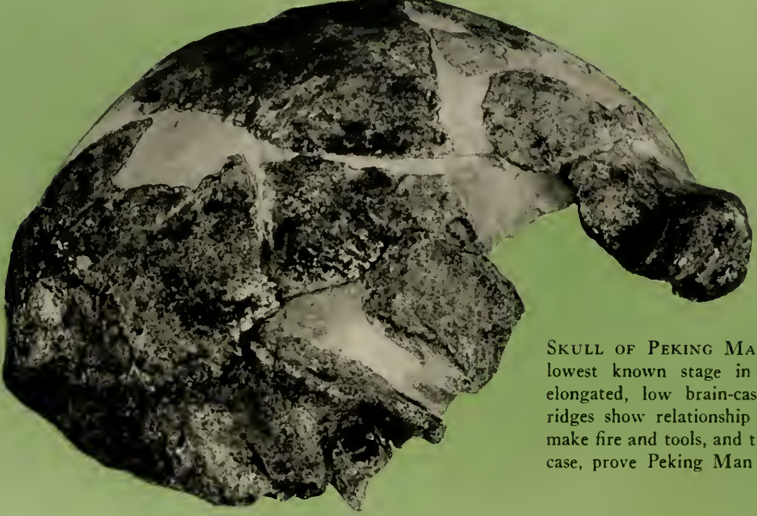
LIKE THE DECKLE-EDGED PAGES of an open book, the sedimentary rocks stand on edge layer upon layer at the base of Split Mountain—a veritable history in rock, embracing over fifty million years. The various layers are delicately colored in pastel shades ranging from blues to brilliant red

Brown Aerial Photograph

(Below) EMERGENCY WORKERS' CAMP near excavation: Mess hall and kitchen at left, dispensary in trees, temporary Museum and office at right.

Upon completion of the heavy excavating, an estimated two and one half years of more delicate work by the American Museum of Natural History's technicians will be necessary to expose and process the tableau of dinosaur remains. The exhibit is heralded as the crowning educational jewel of our entire national park system

Our Most Ape-Like Relative



Skull of Peking Man (*Sinanthropus*): lowest known stage in human ancestry. elongated, low brain-case, and large eye-b ridges show relationship to the apes. Ability make fire and tools, and the capacity of the br case, prove Peking Man a human

By TEILHARD DE CHARDIN

Because he is anatomically the lowest known man and because more abundant remains of him have been found than of any other primitive human type, the Peking Man, who lived some hundred thousand years ago in the vicinity of the modern city of Peiping, is the most important discovery of its kind ever made.

The remains are being found in what was a large cave at the time of its occupancy but which was gradually filled in by falling material from the walls and ceiling. Fragments representing approximately thirty individuals, including five fairly well preserved skulls, have been unearthed in ten years of excavating. The work has been carried on under the joint efforts of the Geological Survey of China and the Rockefeller Foundation.

Situated some 30 miles south of Peiping, this treasure-field was accidentally hit upon by stone-quarriers, and was first excavated by Dr. J. G. Anderson in 1921, for fossil animal remains. When, however, as a result of this early research, two human teeth were recovered by Dr. Zdansky, in association with numerous early Pleistocene animals, a thorough excavation of the site was planned by Dr. Davidson Black, Professor of Anatomy at the Rockefeller Medical College of Peiping, and the work started in 1927. Fifty to 100 technicians and workmen have been continually busy, quarrying, blasting, sifting, and labeling, during each eight-month season since the work began ten years ago.

Among the very primitive characteristics of the Peking Man are the absence of chin, the shape of the teeth, and the size of the orbital ridges. The brain-case is elongated, very low, and a transverse section of the skull is arched as in the apes, instead of being oval as in the Neanderthaloid or in modern man. By such characteristics *Sinanthropus* represents apparently the lowest anatomical stage so far discovered in human ancestry. And yet, he is unquestionably a man, as proved by the shape of his lower jaw, the capacity of his brain-case—(ranging between 900 and 1200 c.c. as compared with the modern average of about 1450 c.c.)—and his ability to make tools and fire, as attested by abundant charcoal and ashes.

The remains of Peking Man are found at any level through a depth of 50 meters, yet do not show any appreciable anatomical change. His stone implements, however, vary slightly but distinctly from the base to the top of the deposit. Curiously enough, the bulk of the human remains are teeth, jaws, and skulls, practically no traces of skeletons having been found, except a collarbone, a first neck vertebra and a fragmentary leg bone.

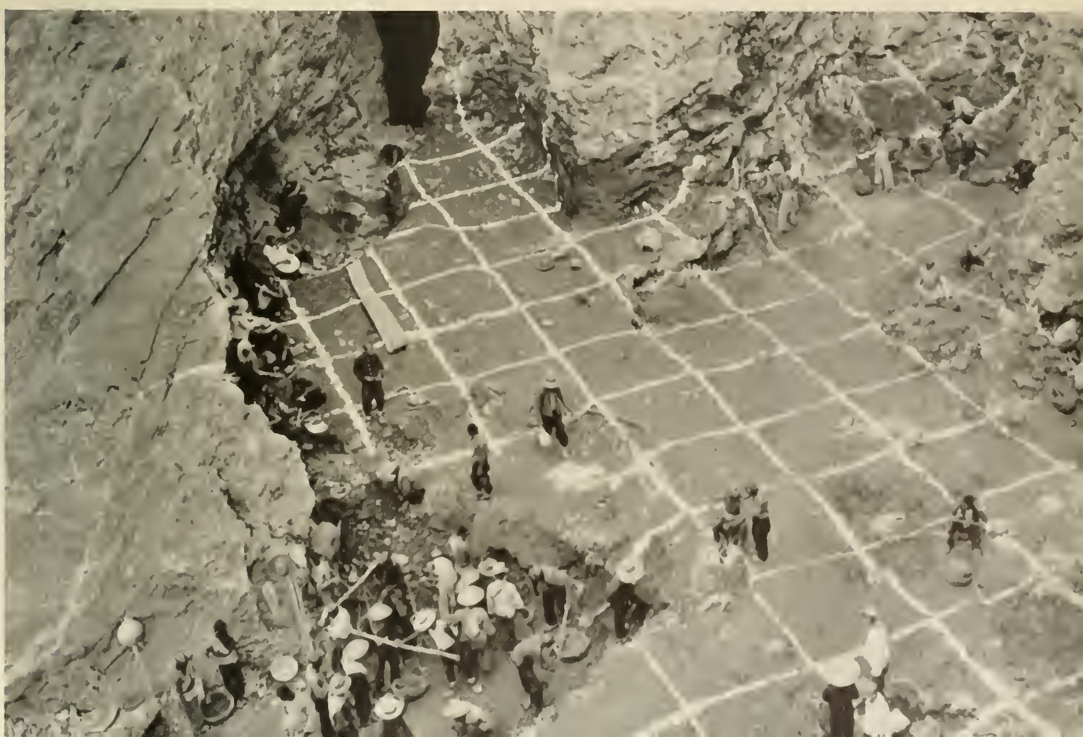
The reason for such an artificial selection of skulls lacks satisfactory explanation.

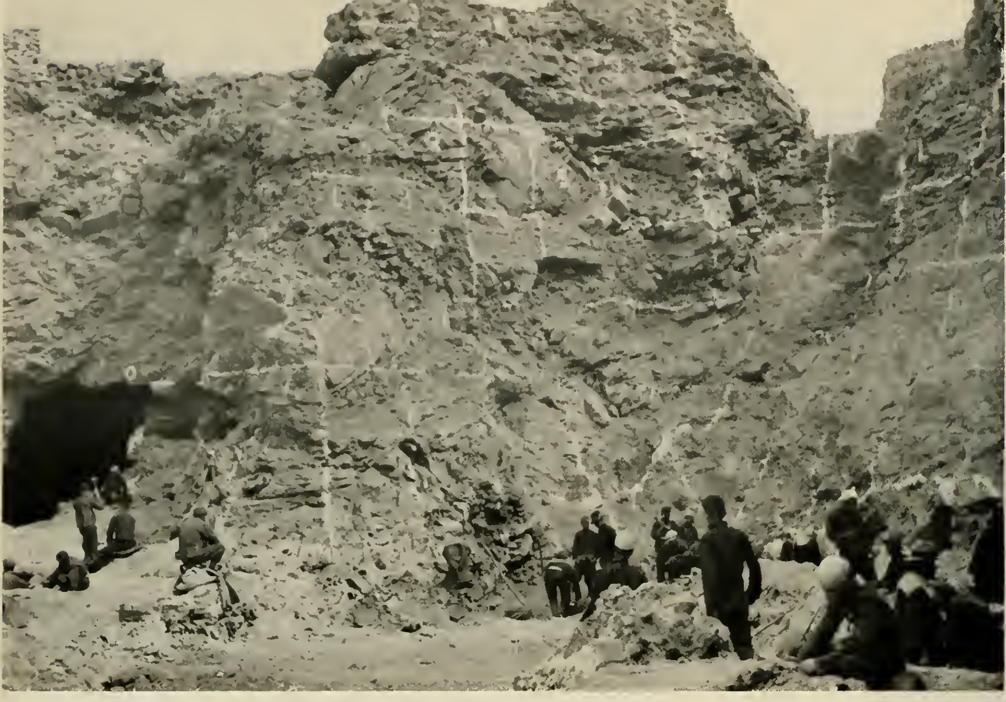
That Peking Man brought many animals to the cave for food, is shown by the enormous number of prehistoric bones, some of which were artificially broken. Most of the forms are extinct: two Rhinoceroses, a big Camel, a Water Buffalo, a twisted-horned Antelope, and a curious Fallow Deer with extremely flattened antlers and thickened skull and jaw. A huge extinct Hyena was probably a temporary dweller in the cave, likewise two types of Bear and, rarely, the Sabre-toothed Tiger. Other forms found are still living in China: the Sika Deer, the Roebuck, the Big-horned Sheep. The age of this fauna, in agreement with several stratigraphic and physiographic evidences, points to early Pleistocene time, a matter of some hundred thousand years ago.

The recent discovery in November 1936 of three of the human skulls in two days strongly suggests that the excavation has now reached the most promising levels. Three more years of work will be necessary before exhausting the central part; and thanks to the kind and powerful support of the Rockefeller Foundation, the Geological Survey of China has decided to carry on to its end the thorough investigation. We have every reason for hoping that this will reveal much new knowledge concerning Peking Man's place in the history of man.

WHERE PEKING MAN WAS DISCOVERED: a limestone hill 30 miles south of Peiping, China, containing the filled-in cave which was inhabited by the lowest known man some hundred thousand years ago. White lines assist diggers in plotting the location of discoveries

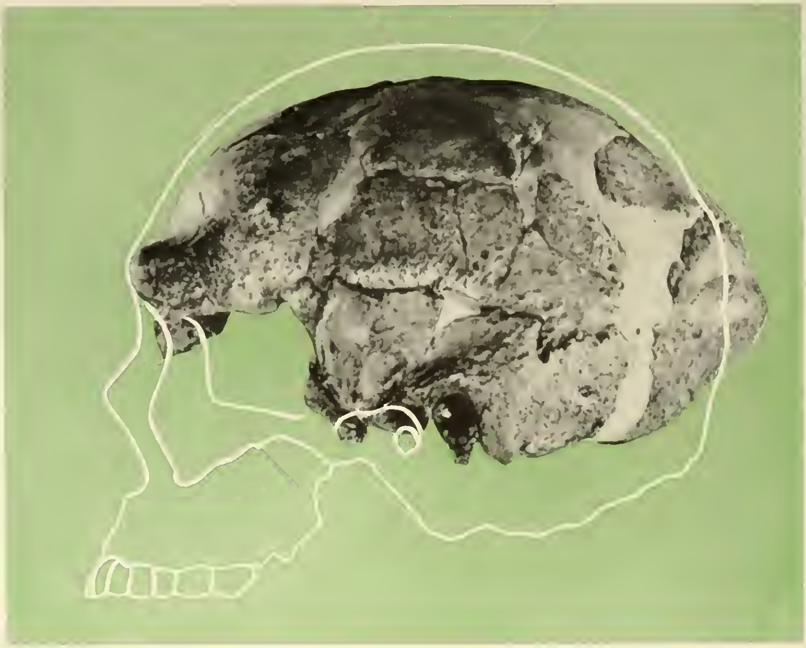
THE EVE OF A GREAT DISCOVERY: Diggers and technicians carrying their work toward the spot, several yards below the arrow, where in November 1936 three skulls of Peking Man were discovered. White lines mark level after twenty-five meters of deposits had been removed; twenty-five meters yet remain before reaching the bottom of the cave

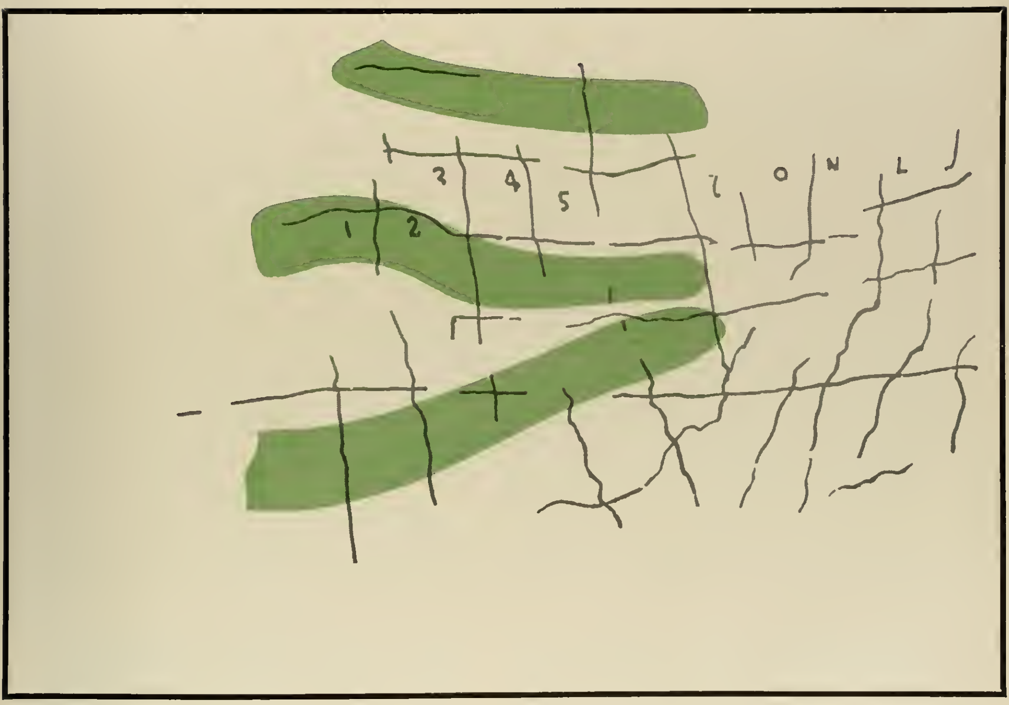




(Above) CRISS-CROSSED WITH REFERENCE LINES and ready for excavation: the eastern front wall of the dig, composed entirely of unworked sediments. The huge pocket of which these deposits are a part is approximately 100 meters long, 50 meters deep and 20 broad

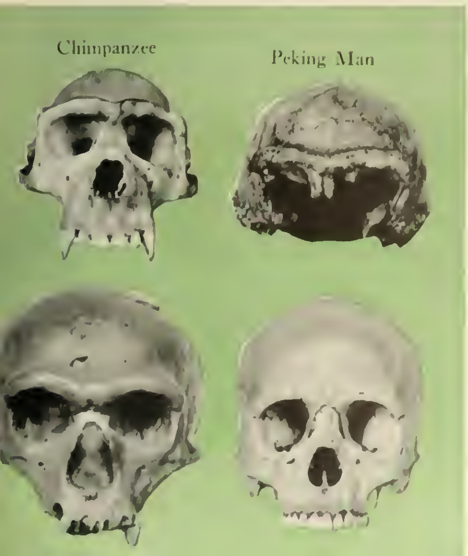
(Below) PEKING MAN'S SKULL COMPARED WITH MODERN SKULL from North China. Note that ancient brain-case is more elongated and very low, and that the eye-brow ridge is greatly extended. These features and others show *Sinanthropus* perhaps a closer relative to the ape than any other known man



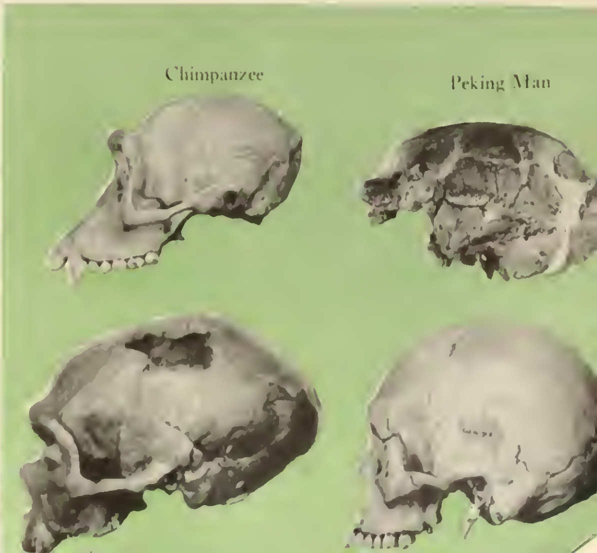


DIAGRAMMATIC VIEW OF BONE-YIELDING LAYERS in opposite photograph. The three solid bands indicate successive deposits, rich in valuable remains, laid down while the cave was inhabited by man or animals. The coarser layers between them are an accumulation of collapsed blocks

the chimpanzee and other apes, instead of oval as in the PEKING MAN'S SKULL in transverse section is arched, as in Neanderthal and modern man



ABOVE THE EYE SOCKETS massive ridges protrude from the forehead of the Peking Man as in the case of the chimpanzee and Neanderthal Man



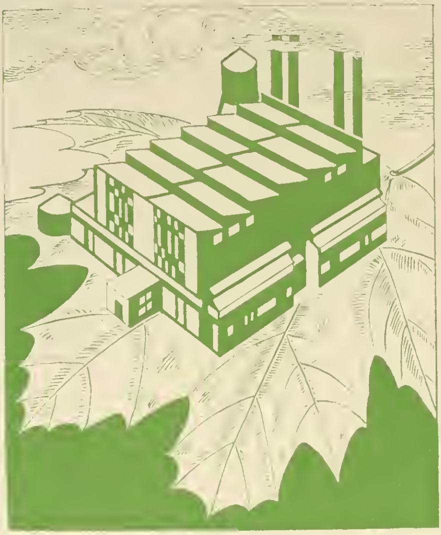
NAKED PLANTS—*Abandonment of the usual clothing of leaves has forced many plants to adopt strange substitutes for the important task of manufacturing food*

By HENRICKS HODGE

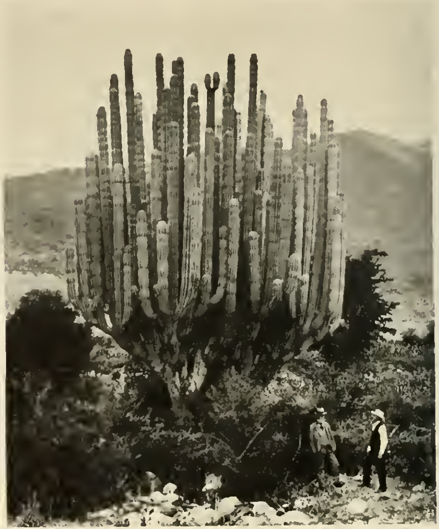
NAKED plants? Yes. There are many of them. A good number of our northern species, particularly the woody types—trees and shrubs—lose their foliage during the winter months . . . hence are naked. But plants that go without their clothing for the greater part of their lives—that is a different question; and yet there are a number of them—nudists of the vegetable world.

Leafless plants are familiar to botanists. In fact all of those forms generally known as the lower forms (pond scums or algae; fungi, as typified by mushrooms and toadstools) are true leafless plants, but in addition they possess neither root, stem, nor flower. The plants concerning which we are to speak are truly naked. As higher forms they are supposed to have leaves—they once had them—but in the course of evolution have reached a stage where they now lack such organs.

To be without leaves is almost as bad as for us to be without blood, for the leaf of a typical plant is the great factory—the manufacturing center where, during light hours, the food is chemically trans-



THE LEAF IS THE GREAT MANUFACTURING CENTER where raw materials are made available as food. For a plant to go without leaves is a difficult undertaking, yet some do—the true nudists of the vegetable world



Ewing Galloway

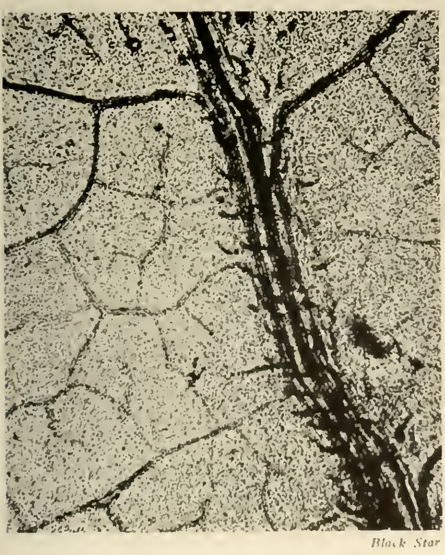
DESERT PLANTS are particularly apt to go nudist, for leaves allow excessive escape of moisture. The necessity to conserve water has led to such grotesque plants as the organ-pipe cactus shown above, and the yuccas, aloes, and Euphorbias formed and made available as nourishment. Why then do these plants lack leaves? The answer, that they may not die, seems incongruous and yet such seems to be the case.

The great majority of true leafless plants are desert dwellers, inhabitants of regions where drought is the rule, rain the exception, and naturally then, like all desert creatures, they must conserve all available moisture. For this purpose they assume the grotesque figures and remarkable shapes which we come to expect of such plants as cacti, yuccas, aloes, and Euphorbias. A good many of them, particularly cacti, are living canteens, water barrels of the desert, and are often filled with a pulp of the consistency of watermelon rind. This watery stem has ofttimes been a source of refreshment for thirsty desert travelers.

To bear leaves under such conditions would counteract their Scottish thriftiness, for leaves are but a plant sprinkler outlet system which releases thousands of pounds of water daily through the multitudes of tiny pores over their surfaces—the pores known to the botanist as stomata. Little wonder then that cacti should want to abolish leaf organs. They had to do so in order to live, for theirs is a life to match the most thrifty of the thrifty—at least as far as the preservation of water is concerned. And so, down through the centuries we can trace the gradual decline of leaves as an important part of the anatomy of desert-dwelling plants. Today the plants best fitted for this life beneath a scorching sun and in blistering winds have lost their leaves or carry them as vestiges of organs that are now but "has-beens"—hangovers of days gone by!

Such a loss has carried with it the threat of death, death from a starvation caused by the lack of good functioning leaves, but few plants there are that can't offset the threat. They have succeeded in a multitude of ways. Always there is compensation. The blind person often develops an unusual sense of touch; the plant also develops a replacement member. The logical plant organ to compensate for lost leaves is that organ which most often possesses the leaf's green coloring matter, and that organ is, of course, the stem.

An examination of the many curious, yet uncommon forms that have been evolved by stems to subserve the leaf function would demand years of



Black Star

A MAGNIFIED VIEW of the elaborate network of veins in a leaf which allow moisture to escape and make it difficult for leafy plants to survive in the desert. Down through the centuries leaves have gradually declined among desert plants

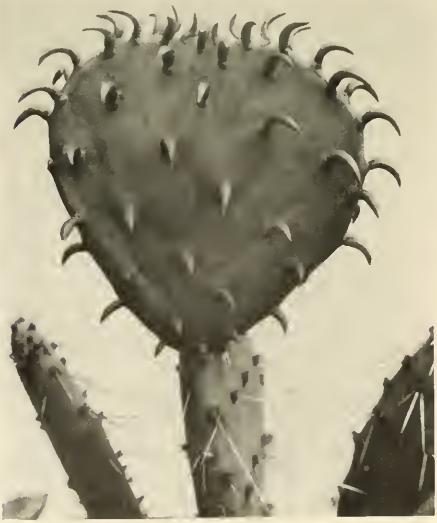
European

A TOUGH "SKIN" permitting slight escapage of water enables the cactus to store moisture in its pulpy interior; and many cacti are living water-barrels. Thorns protect them from the ravages of thirsty animals travel through the dry woods of southern Europe; the prairies of the East Indies; the deserts of Africa, Central Asia, Australia—even to our own western wastelands. Plant members of many varied families would show as many varied, highly evolved stem forms. The most unusual ones peculiarly enough seem to "want" to be leaves—they look like leaves but they are not leaves—they are but much camouflaged stems. To the trained botanist such stems have a definite name, phylloclades (pronounced fil-o-clads). Literally translated the word means "leaf branches," and they are thus named because as stems they possess the leaf function of manufacturing food.

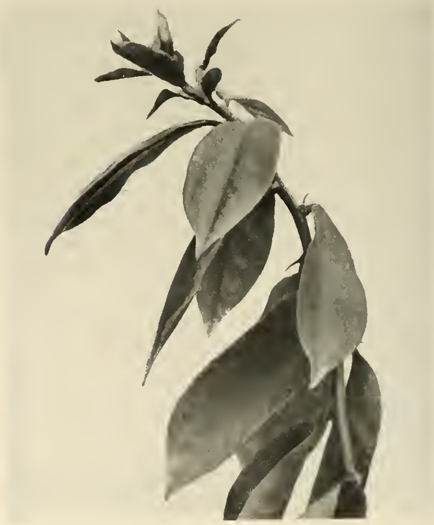
A Doubting Thomas would say, "But how does one know that these branches of stems are stems and not leaves, for certainly they look like leaves?" In answer the botanist has a number of exacting, airtight proofs. Plant organs all differ in internal structure. In the same fashion, even though a fish and a porpoise look similar in external appearance, differences are found in their internal anatomy. Similarly, true leaves and branch leaves may appear alike superficially but a microscopic examination of their internal structure will reveal their differences. Furthermore, take a look at any leafy plant. Where do the branches arise? From the upper angles which leaf petioles or stalks make with the main stalk of the plant. This upper angle is technically known as the leaf axil (literally—a little armpit), and organs which arise from axils of leaves are always regarded as shoots or branches. Stems, then, are always found in leaf axils so there should be a leaf beneath each of our leaf-like stem organs.

Leaves of a sort we can often find, but what leaves! They are usually but tiny, emaciated, worthless (as far as food manufacture is concerned) abortions of what a true, man-sized, efficient leaf should be. It almost seems as though the plant didn't want to give up this proof that it once bore good food-making organs—leaves which have now evolved regressively to the point of uselessness. Sometimes such leaves cling but for a short time and then fall; in other forms they persist for the life of the plant, refusing to be given up. In either case they are definite evidence of the structures they subtend—their mimics, phylloclades.

Let us look at some typical phylloclades. Perhaps



HOOK-SHAPED LEAVES: remnants from an age when the ancestors of our modern cacti were respectable plants and bore normal green leaves. These tiny, succulent leaves of the prickly pear soon fall to the ground, to be replaced by protective spines



A CACTUS which has retained its leaves: the Barbados gooseberry, a living prehistoric plant. From such leaf-bearing forms all present leafless cactus must have evolved. Widely spread in tropical America, the Barbados gooseberry is used for tarts and sauces most primitive—because they most resemble in their cylindrical form what they really are, namely branches—are the phylloclades of the Australian Beefwood or She-Oak, (*Casuarina stricta*). Here the fine stems are seen to droop in feathery clusters resembling the plumage of the emu-like cassowary from which this odd tree derives its scientific name. Shadeless forests, the early explorers called woodlands made up of this species, and little wonder, for sunlight filtering through such finery is little impeded in its path to the ground. The long needle-like branches of this valuable timber tree resemble somewhat the stems of our common horsetails (*Equisetum*) and like them bear reduced scale leaves which persist throughout the life of the individual branch.

Similarly primitive and familiar to all is the mist-like foliage of the genus *Asparagus*, which upon close scrutiny will be seen to consist of multitudes of branches and sub-branches dividing *ad infinitum*. It is as though the leaves had been removed by some invisible hand, leaving the finest of skeleton frameworks—the unmodified stems "pinch-hitting" for absent leaves.

We find leaves absent in Asparagus, reduced but present in Casuarina. On African deserts, where the great succulent genus, Euphorbia, reigns supreme, we can find leaves which are ephemeral. Look at the snaky branches of *Euphorbia Schimperi*. They bear good leaves at the tips—leaves however which soon disappear, handing over their work to the sinuous, cylindrical green stems. From the point of view of evolution, Schimper's Euphorbia has been caught in the active process of losing its foliage.

Our own American wastelands possess some of the best phylloclade-bearing plants—cacti. Widely spread in tropical America is the Barbados gooseberry (*Pereskia aculeata*), so-called because, like true gooseberries, its fruit is made into tarts and sauces. Pereskia is a still-leafy cactus genus and as such might be called a persistent primitive type coming down from far-off days when cacti were respectable plants and bore normal green leaves like their friends. Here we have a start in evolution—a cactus plant with leaves—and from this original condition all present leafless cacti must have evolved. Indeed leafless plants of all types must have been derived from similar leafy ancestors.

WHEN IS A LEAF NOT A LEAF? When it is the broad flattened stem of the night blooming Cereus. Plants without leaves to serve as food factories shift this task to the stems, which contain the leaf's green coloring matter

INSTEAD OF LEAVES the familiar Asparagus plant sends out multitudes of branches and sub-branches dividing *ad infinitum*. It is as though the leaves had been removed by some invisible hand, leaving the unmodified stems to "pinch-hit" for them

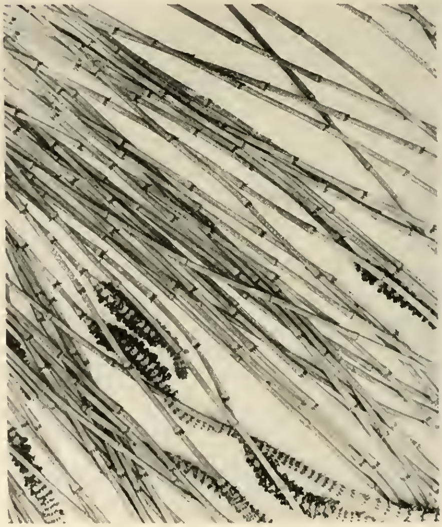
Phylloclades run the whole gamut of shapes from the cylindrical upright pillars of the organ-pipe cactus to the flat streamers of the night-blooming Cereus. Hesitant of spending their lives without the cloaks that green leaves form, the familiar "bunny-ear" varieties (*Opuntia*) attempt to keep modest by retaining, for at least a few months of their lives, worthless awl-shaped leaves, appearing on the new growth like so many little green hooks bending backward.

Queer stem modifications are not limited to the great cactus family. Similar to species of Cereus in possessing stems which are ribbon-like is the genus *Muehlenbeckia,* commonly known in the horticultural trade as "tapeworm plant." The striking worm-like resemblance of this native of the Solomon Islands is caused by the lateral flattening of the main stems, the joints or nodes marking the position of leaf or flower attachment. The flowering "leaf" of the West Indies *Phyllanthus angustifolius,* is another example. What appears at first to be a leaf is found to be, in reality, a flattened stem bearing on it numerous clusters of tiny flowers.

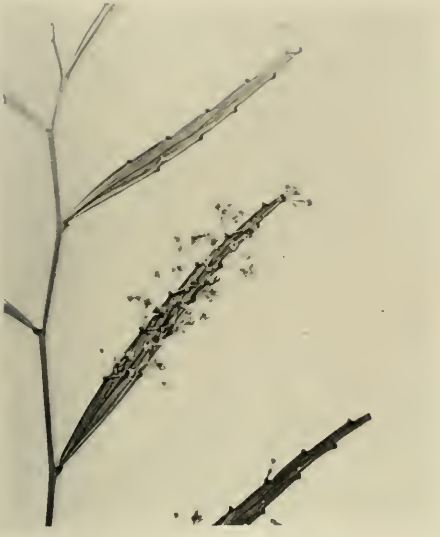
Best phylloclade of all—best because it most resembles the leaf whose job it has taken over—is the stem of the lily genus, *Ruscus.* Species of this plant are frequently known as "butcher's broom" owing to their former use by members of that profession in sweeping clean their blocks. They are erect shrubs with partially woody stems; and, hardy in Southern Europe, are grown in this country in Florida and Southern California. Dried, bleached and dyed (usually red) they have become familiar to the shopper around Christmas-tide, for they are much used in florist's sprays and bouquets.

Like *Phyllanthus,* the butcher's broom bears flowers—seated, however, not on the edge of the branch but on the middle of the upper surface. But what a branch this is!—a far cry from the conservative, rounded, leaf-bearing stems of most plants. Yet in shape these stems of Ruscus are good leaf mimics. As such they fool even the best of us.

THE FINE STEMS of the Australian Beefwood or She-Oak droop in feathery clusters resembling the plumage of the cassowary from which this odd tree derives its scientific name, *Casuarina stricta.* It is valuable as a source of timber

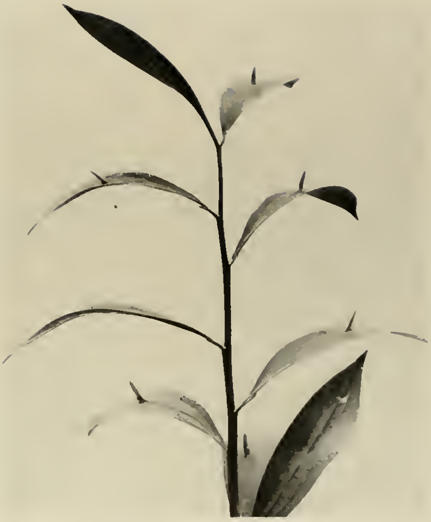


(Above) THE STEMS of our common horsetails *(Equisetum)* are somewhat similar to the long needle-like branches of the Australian Beefwood (opposite) and like them bear reduced scale leaves which persist throughout the life of the branch



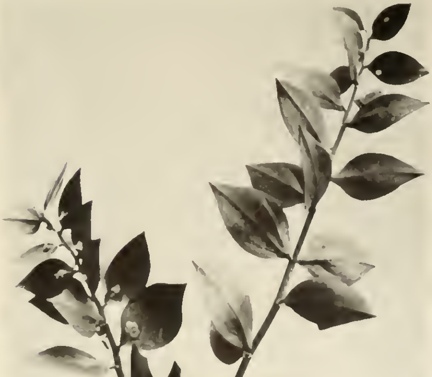
What appear to be leaves in *Phyllanthus angustifolius* are in reality flattened stems, as proved by the clusters of tiny flowers

A plant caught in the process of going nudist. The snaky branches of *Euphorbia Schimperi*, which serve as leaves, bear only temporary true leaves at the tips



A tiny flap leaf growing from each broadened stem proves that *Ruscus hypoglossum* once wore real leaves. It need not blush: it has reclothed itself

Note that flowers grow from the surface of the broadened stems of *Ruscus aculeatus* of the lily genus, proving that they are not leaves



JOSÉ—1937—*The third and final chapter in the life of a Barro Colorado Coati who sought man's care and protection between his periodic forays into the jungle in search of a mate*[1]

By FRANK M. CHAPMAN
Curator of Birds,
American Museum of Natural History

LATE in December, 1936, beginning the third year of our association, I found José in surprisingly good condition. The bare, parchmenty areas, marking the wounds received in his 1936 campaign, had become filled with a new growth of hair, and his pelage generally looked sleek and well-cared for. The nails on his left forefoot seemed to have become reattached to their normal places. A life of ease and unlimited bananas had destroyed the lines of his youth, but he appeared to be in good spirits, his self-confidence, last spring near the vanishing point, had returned, he showed no fear of any other coati, even took the aggressive and drove away some males whose presence was undesired. But he lacked the snap of younger males, his remaining eye had lost its sparkle, and his tail that rolling, twisting, curling motion so expressive of the devil that lurks in a fully charged coati.

Renewing friendly ties

His food-supply at the kitchen door being cut off José at once looked to me for his daily bananas, and the relations which had been discontinued since the preceding April were soon reestablished. At first he came to my front, or kitchen-side door, but he would enter and follow me through the house or go around outside to his former feeding-place on the balcony in the rear.

At once I discovered that José's wire-climbing days were passed. He might mount the balcony railing for a banana and he even pulled at the string attached to the feeding tray, but it was a half-hearted attempt and he much preferred to take his bananas from my hand and have them peeled for him; and in the belief that his record as a gymnast had won him honorable retirement from further exhibitions of agility, I asked him to ascend only to my knee.

My intimacy with José and his confidence in me now reached their highest point. He permitted me to stroke his back. There was a time when I should have expected this familiarity to be actively resented, or at least to arouse the impulses of uncontrolled fear, but, beyond an instinctive recoil from so novel an experience, he showed no dislike of it. Indeed, there were times, possibly when I rubbed an itching bite he could not reach himself, when he seemed to welcome my touch. But my hand was equally liable to find some sore spot, and how was he to tell that my intentions were always of the best?

His last mating expedition

The weeks passed without incident. I was interested in other things and took José for granted. The time was now approaching when, José's history showed, there would be a change in his nature and in response to the demands of his sex cycle he would go to the forest to seek a mate. In 1935 he had disappeared on January 29; in 1936, on January 27. When would he be called in 1937? My journal records him as coming for food at 6 p.m. on January 26, but he was absent the following day which proved to be the day of his going. In three years, therefore, there was a variation of only three days in the beginning of his annual mating expedition, an indication of the remarkable regularity of his physiological cycle.

In concluding my record of José for 1936 I had ventured to predict that under the care of his friends at the laboratory he would survive until the mating season of 1937 forced him again afield when he would succumb to the attack of a younger and better armed rival. The application of the law of the "survival of the fittest" calls for the defeat of the animal whose powers are below the average, and José, assuredly, could no longer be numbered among the "fittest." Handicapped by the loss of his right eye he had done remarkably well to survive the

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[1] The preceding chapters will be found in NATURAL HISTORY for April, 1935, and September, 1936.

José—1937

HALF TAME, HALF WILD: the coati whose intelligent acrobatics and periodic forays into the jungle in search of a mate have been described by Dr. Frank M. Chapman in previous issues of NATURAL HISTORY

BATTLESCARRED and no longer to be counted among the "fittest" after his 1937 mating expedition, José was not destined long to survive. The dry shelter of a Barro Colorado home appealed to him as never before, and he seemed prepared to "go human"

SLEEP AND MORE SLEEP was his chief desire, and for his repose he chose the space beneath the bed of the man who had always been his friend. Finally the noble little animal, fast losing his grip, sallied forth into the jungle never to return season of 1936, but the injury in that year to his left foot was equally serious. A coati's claws can inflict terrible wounds. Normally they are used for digging, climbing and holding his food, but in combat they are his most effective weapons. With them he can tear such openings in his rival's body as José himself received during the campaigns of the two preceding years. The fact that José had detached all five claws of his left forefoot in 1936 is indication of the hard usage he had given this member. Some pointed one way, some another, some were loose and hanging and it seemed impossible without an operation, to restore them to their original position. This, however, was out of the question. The foot evidently gave José much pain and an attempt to handle it would have been violently resented. But although in some ways the claws had approximately resumed a normal position I had small faith in the strength of their attachment and hence in the value of the foot as a weapon.

In addition to his physical defects José was unquestionably out of training. In place of the life which makes a coati one of the most active and hardy of forest animals and induces him to find one meal at the end of a tarantula's burrow and the next at the top of an almendro tree, he had been living almost exclusively on bananas and was, therefore, deprived of both exercise and a hardening, varied diet.

So the odds seemed against José and we anxiously waited his return. Personally, I believed that we would never see him again. In 1935 he had returned on February 11; in 1936, on February 10, after absences, therefore, of respectively thirteen and fourteen days.

A fleeting glimpse

Nine days passed when at noon on February 4 José, at full speed, crossed the clearing in front of the laboratory. No one followed him and he evidently was on a trail. I called his name sharply and he apparently recognized it, for he stopped and, sniffing the ground, began to retrace his steps; but he paid no direct attention to me or to the peeled banana I offered him, and soon disappeared in search of whatever he was hunting.

This was a very different José from the semi-domesticated animal that had daily come to me for food. Once or twice I thought that he was about to yield to the combined influences of my call and the banana, but whatever obsessed him was a stronger lure. Apparently, he was still controlled by the influences that had induced him to go to the forest. He seemed alert and active and prepared for whatever he might encounter. Beyond a bare patch on the left flank I could not observe that he had been injured.

It was February 13 before I saw José again. He was in the distance crossing the clearing near the lake and seemed to be still concerned with his own affairs. On the 18th, however, he came to my door and this date I enter as the official time of his return. But he was still quite unlike the José that had left us on January 27. Before I could reach him he started for the forest. I followed quickly with a banana. He took one piece of it but his mouth appeared to be badly injured and he ate with difficulty. He looked very thin and worn and seemed to be in a thoroughly exhausted condition; but beyond the trouble with his mouth I could see no serious wounds. Rest and seclusion seemed to be his chief wants but for some unknown reason he sought them in the forest rather than with us. The wild and tamed in him seemed to be at odds, with the former in control.

José's last days

We now saw José at intervals but he did not shake off his feral spirit fully and reacquire confidence in us until February 28. My journal for that date reads: "José came at 8 o'clock this morning and stayed. He shows no major external injuries but has many minor bruises and is evidently tick and red bug ridden, for he scratches himself constantly, sometimes with both forepaws at once. It is in his actions that he differs most markedly from the José of a month ago. He seems drugged. He does not respond to his name, takes a banana reluctantly, eats slowly and awkwardly, the wound at the base of the right side of his mouth evidently interfering with mastication. Most of the time with hung head he sits dejectedly, moving only to scratch, or crawling beneath my bed to sleep. I cannot diagnose his case satisfactorily, but beyond question he feels badly and is in poorer condition than when his wounds were more obvious. Possibly he may have been hurt internally, possibly he has over exerted himself. In any event, he is in bad shape."

On former occasions José had occupied a corner beneath my cot for an hour or more. Now he apparently decided to make my home his. There were no other coatis about the laboratory and no need, therefore, for protection from others of his kind. But a dry shelter, free from attack of insects, other than those that had already taken possession of him, with an unfailing supply of food for the asking, seemed more desirable than the forest and he was prepared to "go human." I was more than willing to share my quarters with him during the day, but

Continued on page 538

THE INDOOR EXPLORER

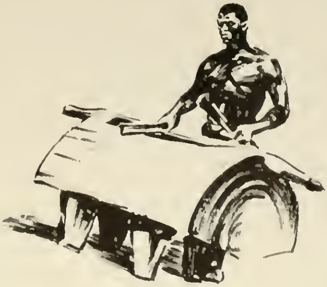
The Radio, the Drum and the Indian

If you have ever been inside one of those gorgeously modern broadcasting studios, you must have felt at least a mild curiosity at all the sound-making gadgets which come perilously close to tripping you up or barking your shins at every turn. Your Explorer means the xylophones of varied shape and tone, the cymbals, the drums, and the abundance of odd-looking sticks and brushes with which clever people beat on the drums to get all manner of sound effects.

The uses of these vehicles of noise fascinated this Indoor Explorer during a brief tour of the citadels of radio this summer. He was amazed at the indefatigable imagination and ingenuity of the people whose craft it is to make noises. Theirs is a life of unending adventure. Did your Explorer call the occupation a craft? It is more than that. It is both an art and a science. For the mechanical skill involved in the actual production of the sounds is surely an esthetic accomplishment, and the research, so painstaking and ceaseless, which is expended in selecting the best soundmaking materials is patterned on unimpeachable scientific method.

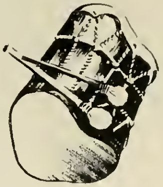
Not all of the sounds necessary for radio drama can be produced through the use of the above-mentioned percussion instruments. That is only the beginning. Here is a typical sound-maker's problem, requiring something beyond the power of drums and xylophones. The program calls for the re-enactment of a brain operation performed on a famous statesman. This particular program goes in heavily for realism, and so, of course, there must be the sound of the surgeon's scalpel cutting through brain tissue. A bit grisly? Yes, but it's workaday routine for the noise makers. Trial and error is their stock in trade and in this case no stone is left unturned in an effort to get what the French, in their infinite exactitude, might call *le coup juste*. One man sits in front of a sensitive microphone, surrounded by an assortment of raw liver, bologna, and other meats and sausages. Patiently he cuts off various thicknesses, with knives of differing size and keenness. Inside the control room his colleague listens to each incision, carefully appraising its dramatic value. None of the meats will do. They are swept away and replaced by an assortment of vegetables. Once more the sound-maker takes up his knife and goes to work on carrots, potatoes, squash . . . unsatisfactory. All right, here comes the fruit bowl. That's it, that's perfect! What are you cutting? Bananas. Bananas? Yes, bananas lengthwise with their skins on.

Such are the ways of the noise-maker. But what interested your Explorer most about the sound business was the importance of those drums and xylophones that cluttered up the studio. Now these instruments are of very ancient origin. The African Hall at the American Museum contains a collection of drums of every imaginable size and design many of which were devised by primitive man to solve the tremendous problem of communication over distances too great for the sound of human voices to carry.



The radio is, of course, the greatest of man's achievements in solving that problem. But if the reader has never examined the appurtenances of the radio studio, he cannot realize the extent to which the broadcasting engineer has depended upon the earliest tools evolved by man for the mechanical transmission of sound. In the great broadcasting stations, the xylophone almost invariably accompanies the station announcement. The drums are put to a variety of uses in producing dramatic sound effects. With equal facility, they provide the crash of a train wreck, or the sloshing of waves against a ship at sea. The microphone, of course, does all the transmitting, for the drum and xylophone have quite outworn their usefulness as media for an articulate language.

But such was not the case in the primitive world. And even today in some sections of Africa and with many ocean peoples the drum and the xylophone still linger as among the most important implements in native life. In the primitive world the drum was the savage's telephone, his telegraph, radio and daily newspaper, his fire and police alarm. If the art of drum making were to be lost, it would be no less a calamity to him than if civilization were one day to awake with all its electrical means of communication a mere wreckage of scrambled wires with no one able to repair them.



Primitive drums vary in function, material and design with the localities in which they are found. There are African messenger drums so big in diameter that a grown man can sit comfortably inside one of them. These are made by hollowing out the trunks of large trees, and the sound is produced by beating on a slit in the wood without resorting to hide stretched across an opened end. On the other hand, tiny drums less than six inches long have been found in other sections of the dark continent. The African xylophone was in use as early as the sixteenth century. In some forms it resembles the suspended drum; that is, a drum hanging by thongs from a cross bar held up by two poles. The image should be familiar to all who have seen those rural villages where wagon wheel rims serve as fire alarms.

In a single day the savages would use their drums many times and for as many purposes. In the morning the hunters went forth to see if their gods had been good to them and led game into their traps. The hunters split up into small parties and made their way singly or in pairs to those places where they had dug their pitfalls the day before. One hunter on arriving at a trap sees a large water buffalo stamping and snorting in the trench. Quickly he rushes to a large tree. Part of the trunk of this tree has been gouged out so that the resulting hollow section can be used as a drum. Snatching up a stick he beats a rapid and intricate tattoo on the drum-tree. If you listen carefully you can hear his message picked up by a tribesman who relays it by a similar device to other hunters. Thus the news of the water buffalo's capture is echoed by drum-tree after drum-tree until all the hunters have heard the message and are falling over each other's heels in an effort to be the first to reach the prey.

Among some tribes these drum-trees were located at regular intervals throughout the jungle surrounding their village homes. They bear a remarkable likeness to the green telephone boxes which you find in large modern communities attached to street lamps within reach of the policeman on his beat, and, incredible though it may seem, in the performance of this particular service, there is little to choose between the telephone and the drum-tree.

The most notorious of all drums is, of course, the savage's war drum. "The stillness of the night was broken by the weird beating of tomtoms" is perhaps the most time-worn cliché of all in the realm of lurid fiction, but it has its basis in fact. When a fiction writer uses this phrase, he is usually referring to the tribal ritual which is carried on in preparation for war. War dances are all very well, but the drum serves a more utilitarian purpose when used to communicate the news that the enemy tribe is about to attack. War-like savages often equip their sentries with drums by which they can give the general alarm at the first indication that hostilities are about to begin. In the same way, the drum warns of the nature and nearness of all impending disasters whether fire or flood or ravaging warriors.

Not unlike a tribal newspaper, the drum sends the news of births, deaths, marriages, and other kindred occurrences. It also transmits messages which approach the banality of late afternoon telephone conversation in any American city today. For your Explorer was told of how one chief sent a series of drum messages reverberating through the jungle simply to inform his household that he intended to come to supper that night. The story made no mention of whether or not the chief would bring along "one of the boys with whom he was trying to put over a big deal," but one suspects that such affairs are not unknown to our savage brothers.

To return to the analogy of the newspaper, one might say that the drum offers to a savage community all the advantages that a "reader's opinions" page gives to the modern citizen. For when a black man gets angry at somebody or something, it is not uncommon for him to seize a pair of drum sticks and send forth a flood of abuse in drum-beats directed against whatever it is that is irritating him at the moment. In this way, a whole tribe may take it into their heads to insult a neighboring tribe with whom they are not on the best of terms, and the wilderness is immediately set ringing with caustic accusation and counter-accusation.

This brings us to the essential difference between the radio, the telephone, and the savage drum. Like the telegraph, the drum requires its own language. But it does not confine itself to the comparative simplicity of the Morse Code. Some tribes in the Cameroon have become so articulate with their drumsticks that by the use of trills and varied cadences they have learned to get all the sounds that could possibly be gotten out of their drums. From these sounds they have constructed a special drum-language. Although this language is not the same as that used in everyday speech, it can nevertheless be "spoken" by imitating the drum sounds with the mouth. Thus some black men are bi-lingual, having both a spoken and what might accurately be called a "beaten" language. The invention of this drum-language is not as difficult as it seems at first glance, because many primitive languages are largely made up of repeated sounds in various orders and rhythms. For instance, one syllable may be used interchangeably as a suffix, a prefix, or even in the middle of a word and yet the three combinations have entirely different meanings. So it can be said that the drum in the savage world parallels neither the telephone nor the telegraph but is a sort of a combination of the two, having some features of each.

There were other communication techniques known to primitive man besides those of percussion implements. The one that inevitably comes to mind first is the celebrated North American Indian's smoke-and-blanket system of signals. As nearly everyone knows, Indians lit fires, partially smothered them with damp brushwood and controlled the outpouring of smoke by means of a blanket manipulated above the fire by two or more of their number. In this way, they were able to communicate with each other over considerable distances, using a code of dots and dashes not unlike that employed in modern telegraphy. At night they varied the process to suit the changed conditions by controlling the flame of a brightly burning fire with a damp blanket so that it could be momentarily obliterated and then suddenly allowed to burst forth in different gradations of brightness.

The preference shown by the Plains Indians for this visual method as opposed to that of drums is partially explained by the character of the country in which they lived. Great rolling plains dotted here and there with rocky hills favored a means of communication relying on visibility rather than hearing; whereas dense tropical growth would be a serious handicap to visual communication among jungle peoples. Then there is the matter of rain. The Indian method would not have been reliable in an environment visited by prolonged rainy seasons. It was particularly suited to the arid prairies of the American West where sunlight was abundant and was usually accompanied by clear atmospheric conditions. Hence, although the Indians did possess drums, they emphasized visibility in their communications. This is evidenced by their picture writing as well as their mechanical contrivances. Among the latter was the flaming arrow from which our modern sky-rocket is derived. They took an arrow and attached some inflammable substance to its tail, lit it, and shot it high into the air. After the coming of the white man, gun powder was mixed with pitch and smeared on the arrow, replacing the twisted straw dipped in oil which was the more primitive firebearer. The flaming arrow was frequently used by advance scouting parties to signal the most strategic moment of attack or retreat, as the case might be.

The heliograph, which until recently was an important adjunct of war-time maneuvers in the field, was well known to the Indians. There were no glass mirrors but many reflective substances of almost equal efficiency were developed—polished quartz, was used and in some cases, large plates of burnished native copper.

The drum-beating African negro and smoke-signaling red man present a study in contrasting temperaments which is, to say the least, interesting. The American Indian is traditionally pictured as grave, phlegmatic and taciturn. So it is perhaps fitting (or it is an inevitable part of his social and environmental complex, depending on the way you look at it) that he would prefer instruments of visual communication. Visuality restricted volubility. Confined to a limited code system, the Indian's messages could not be given in great detail, and with the necessity of precise understatement thus imposed, he would have to concern himself only with the barest essentials. Whether the Indian's taciturnity can be attributed in part to his restricted means of communication (his smoke signals, sign-language, and picture writing), or whether the restricted means of communication arose because of a native taciturnity, or whether both are products of that intricate interplay of forces known as a complex—is a difficult anthropological problem which your Explorer does not feel quite up to unraveling. But he shudders to think of the possible situation in which an African savage bubbling over with a particularly juicy diatribe against his personal enemy is furnished with nothing but a half dead fire and a wet blanket with which to convey his turbulent feelings. Spontaneous combustion would, in all likelihood, be unavoidable. And yet, the situation is no more grotesque nor more startlingly indicative of the vast differences between the two races, than the nightmarish vision of an Indian jazz orchestra pounding out a wildly negroid "swing" arrangement of, say, Cadman's "In the Land of the Sky Blue Waters."

Mention has already been made of the uses which modern radio has found for the African's drum. Yet amid all its natural preoccupation, with instruments of sound, radio has not entirely discarded the Indian's visual method. And your Explorer does not mean television. He means—but let us return to the broadcasting studio. A program is being rehearsed. Scripts in hand, the performers are huddled about the microphone. As each actor reads his lines, he keeps one eye on what appears to be a window in the wall of the room. Behind the sound-proof glass of this window, is a small chamber. Its furnishings are largely taken up with dials, switches and shining electrical machinery. It is the control room. Its most conspicuous occupant, listening intently to each sound that comes over the microphone, is the program director. All eyes are on him. For through the window, he can see and be seen; but no sound save that traveling on the microphone wires can be heard. So his directions are all given by sign language. His hands like an orchestra leader's communicate his commands to the actors. A little closer, please. Softer. Speak into the microphone. Don't rattle your script. Pick up your cues a bit faster. *Don't kick the microphone.*

No, the Indian sign language has not died out, nor will it ever disappear as long as circumstances arise in which communication by sound is either inconvenient or impossible.

Sign language is closely associated with the Plains Indians because they exploited its possibilities more thoroughly than any other people. Oddly enough, its rapid growth among them was due to the horse. Although the latter-day Indians were famous riders, horses were unknown to the original Americans until Cortez and others brought the animals from Europe. In the days before the Spanish horse had spread northward from Mexico, the western tribes, contacted each other so infrequently that there was no opportunity for the development of a common language. But after the horse had been domesticated and the Red Man had begun to roam far and wide across the prairie the commingling of various tribes was inevitable and immediately there came a pressing need for a ready-made means of communication. The problem was solved by the development of sign-language.

The next time you tune in your radio, you might pause to reflect that although your entertainment is provided by modern engineering genius, you nevertheless owe a debt of gratitude to the heritage of simple devices handed down by primitive man.

—D. R. Barton.

YOUR NEW BOOKS—*Snakes Alive—Shark Hunting—Island Wanderings—Life in the Yellowstone—Lore of the Lyrebird—Spanish Trails—Prehistoric Art—Nature's Mysteries*

SNAKES ALIVE AND HOW THEY LIVE

- - - - - - - - - - - - - by Clifford H. Pope

Viking Press, $2.50

SUPPOSE that you were presented with a simple arrow such as the modern archer uses. Now assume that, using only this one as a basic plan, you were told to construct more than two thousand different types of arrow. Furthermore assume that each type had to be nicely adjusted to fit a particular use. The imaginary problems involved in this supposed task of designing arrows will give you some idea of the extent of the problems solved in the evolution of the snakes. For these reptiles number somewhere around twenty-four hundred species, and each is especially suited for existence in its particular part of the world, each is equipped to secure its particular kind of food.

In ***Snakes Alive*** you may learn a great deal about these various modes of existence, why there are large snakes and small ones and what advantages there are in these sizes, why some snakes lay eggs while others do not, how a male snake distinguishes a female of his own species during the mating season, and how a snake is able to get along without eyes. These and countless other facts have been gathered together and presented in non-technical terms so that anyone may understand the complicated processes involved in the production of antivenin, or the difficult mechanics of snake locomotion.

By far the best balanced popular book on the subject yet published, ***Snakes Alive*** includes accurate information covering all phases of snakes' lives, their economic importance, their distribution, their use in medicine, and their significance in folklore. Unlike many previous books which have consisted of little more than collections of "snake stories" this one is really a popularized survey of a vast scientific literature. Anecdotes are used only to illustrate habits or characteristic behavior of certain snakes. Much information in the book has never before appeared outside of scientific journals, and thus for the first time will become known to those who are not specialists.

Anyone who previously has had only a meager knowledge of reptiles will be astonished to find what a diversified group snakes are. The simple ground plan of all snakes, an elongated body without limbs, has undergone all sorts of modifications to make it possible for snakes to live in the ground, to burrow in sand, to swim in the ocean, to climb up into trees, or to travel efficiently on flat surfaces.

Snakes Alive is well illustrated with more than sixty excellent photographs which have been well chosen and placed in the book in such a fashion that they may be readily referred to in connection with the text. The book also includes a summary on classification and an appendix which provides the first complete popular key to the snakes of the United States, with illustrations and other information concerning its use. With this key anyone should be able to identify native snakes, and it is hoped to be able to add to our knowledge concerning them.

The entire book is well planned, up to date, and thoroughly reliable. No reader can fail to find himself enlightened and interested in snakes, and no amateur who finds the study of snakes enticing can afford to be without this book if he is to have a sound background for an intelligent understanding of his subject.

C. M. BOGERT.

ROAD MY BODY GOES

- - - - - - - - - - - - - - - - by Clifford Gessler

Reynal & Hitchcock, $3.50

TEPUKA a Maruia, the subject of this book, is a lonely, coral island on the eastern margin of Polynesia, on the very threshold of the vast sea which separates the Pacific Islands from America. It is one of the Tuamotu, or Paumotu islands, which are a series of some 80 coral atolls scarcely rising above the level of the sea. They are like the meshes of a cosmic net, catching the furthermost wanderers of Ancient Polynesia. Low-lying and washed by treacherous currents they were once known as the Low or Dangerous Isles. Poor in natural resources they have offered little attraction to casual visitors or to commercial exploitation. Thus the dangers of navigation and the austerity of nature have combined to protect these isolated fragments of the larger Polynesian world from the destruction of native life which has occurred in Hawaii, Tahiti, the Marquesas and New Zealand. Each of these thin, coral, ring-like islands is, in a sense, a little world of its own. Their only contact which is with Tahiti is infrequent and uncertain at best.

Life on Tepuka is simple and unvarying. The fundamental preoccupations of getting a living and begetting offspring constitute the major content of existence. And yet such simplicity can be transmuted into great dignity by a warm emotional spirit and by an epic, mythological poetry, both of which the Tepukans possess; the former a part of their nature and the latter a relic of their Polynesian heritage.

I have an especial interest in Mr. Gessler's account of Tepuka because in 1929 I lived on this island for two weeks and this story of my friends there and their round of accustomed occupations has quickened to life my recollections.

Mr. Gessler has recorded with sensibility and without false emphasis the daily lives of an uncontaminated Polynesian community. And by doing so has created one of the few reliable and undistorted popular descriptions of Polynesia of which I am aware. His appreciation of the subtleties of native thinking and his intense sympathy with the islanders lend an exciting quality to his narrative. I recommend this book highly for anyone who wishes to learn what life in the remoter islands of Polynesia is like.

H. L. SHAPIRO.

TIGERS OF THE SEA

by Col. Hugh D. Wise, U.S.A. (Ret.)

Derrydale Press, $10.00

FOR countless centuries sharks have been man's enemies. But now, adding materially to the sum of human knowledge, comes a book which not only finds much good in these predatory sea rovers, but dares to express an emphatic opinion that sharks are creatures of singular beauty, and rare sport.

Dip into the spray-drenched pages of *Tigers of the Sea* and a new adventure in the annals of sport will, like "magic casements opening on a sea of foam," carry you to far lands and thrilling hours beneath tropic skies.

Fights on rod and reel hold a lure not to be denied, and with Colonel Wise the reader tracks down the voracious monsters in their lair, sees their snapping jaws as they rush the bait, hears the high-pitched whine of the spinning reel and feels hundreds of pounds of fighting fish tortured into a rage by the huge, tested steel hook and all the resistance of a veteran angler at the other end of the line. The excitement and thrills incident to angling, to big-game hunting, to deep-sea fishing, concentrated into battles of brawn and wits with tremendous sharks, present in fine detail the latest of new sports—to be found right off our shores. For up and down both coasts, in the crystal waters of the Bahamas, and elsewhere, Colonel Wise pursues his novel hobby of angling for sharks.

It was interest in the big fish which led me to write a book on sharks, and to meet Colonel Wise, the implacable nemesis of all species. Later on, we went shark fishing together, and I learned to know and appreciate the Colonel's thoroughness and equipment, his sincere sportsmanship and the underlying causes of his attachment to this exotic past-time. Such causes he explains fully in his admirable book.

On the other hand, he neither neglects the informational and educational side of the shark question, nor fails to include in particular detail the exact, tabulated equipment for a successfol and exciting raid on the mighty fish in any given locality. The characteristic fighting qualities and tactics employed by various species he explains adequately enough for the sport fisherman to recognize his quarry on the hook, and act accordingly. He includes an appendix of diagnostic points of the more common species frequenting our shores for identification of catches. In addition, he has been studiously diligent in observations of a scientific nature which might contribute a few more facts to our knowledge of these ubiquitous fish, and presents these with the substantiation of much shark lore from the waterfront talk of years.

No one who enjoys red-blooded adventure will be able to put the book down without at least a secret hope that he may sometime witness if not participate in just such sunlit days and cool evenings, with sharks on rod and reel. Who can ask for more?

HORACE S. MAZET, F.R.G.S.

THE LORE OF THE LYREBIRD

by Ambrose Pratt

Robertson & Mullens, Ltd., Melbourne 5/s

THE three known species of lyrebird, sole members of their order and family, inhabit the dense forests of the mountains of eastern and southeastern Australia. Although about three and one-half feet in length, the nature of its haunts, terrestrial habits, and shyness make this lyrebird exceedingly difficult to observe and the chief contribution to its biography contained in this little volume is the history of an individual bird that made friends with a flower-grower whose home was in primeval growth on the slopes of Mt. Dandenong twenty-odd miles from Melbourne. Eventually an amazing degree of intimacy developed between Mrs. Wilkinson and her distinguished guest who used her verandah railing for its daily display during the nesting season of singing and dancing. Here it was seen by many visitors and photographs, some of which are shown here, were secured of its characteristic attitudes.

To this unique story is appended a very readable general history of the known habits of the species. If the author sometimes humanizes his subject, we must admit the strength of his temptation.

F. M. C.

BUGS, BIRDS AND BLIZZARDS IN THE YELLOWSTONE

by Harlow B. Mills, Ph. D.

Collegiate Press, Inc., Ames, Iowa

THE life of summer, autumn and winter in the Yellowstone is reflected in these pages from the journal of a Park naturalist. He shares with us his observations of the land, its seasons and inhabitants and also his experiences as a ranger. And as we sense the breadth of the canvas on which his picture is painted we rejoice in the foresight that has set aside these vast areas where flora and fauna and the environment in which they have developed, are preserved for all time.

F. M. C.

MYSTERIES OF NATURAL HISTORY

by E. L. Grant Watson

Frederick A. Stokes Company, New York, $1.75

PUBLISHED in England as *Enigmas of Natural History,* these twenty-four essays now issued by an American company, deal with life histories of insects, vertebrate animals, and plants involving cases of complicated adaptation. As insects in their changeful lives from larvahood to transformed adults often undergo amazing adjustments to radically different sets of conditions, it is from entomology that many of the examples are chosen. However, besides insects, the subject matter includes floral and faunal adaptations to desert life, nature partnerships between hermit crabs and sea anemones, sharks and pilot-fish, sloths and algae, as well as vitality in snakes, the curious life history of such degenerate parasites of crustaceans as *Sacculina* and *Thompsonia*, the physical set-up of the whale, and the building accomplishments of the beaver. There is even a chapter on the "Farmer's Friends and Foes," which fits a little angularly into the general scheme of the volume.

Some of the instances cited by the author are drawn from his own observations in Australia and England but rather more instances are popularizations of his specialized reading. The interdependence of the *Pronuba* moth and the yucca plant and the unusual structural equipment that enables this moth to pollinate the plant and thereby assure the maturing of the seeds on which its larvae are dependent, form a theme that Riley explored decades ago, but the facts are so interesting that they will bear repetition.[*] Similarly Fabre's observations on the construction of the urn-shaped nest of *Eumenes amedei* (more correctly *arbustorum*) which are related in the present volume may be familiar to some readers who nevertheless are possibly unware of the fact that this genus occurs also in America and that observations on its building methods can also be made here.

Be it said in commendation of the book that it is written not only with clarity but with animation. Because of the intricate complexity of some behavior patterns the author more than once expresses doubt as to whether attempts at explaining them really explain. Once or twice he advances, if diffidently, a theory of his own—for instance, when he tries to account for the paralysis of effort, the hopeless surrender to fate, that deprives the rabbit of its instinct for self-preservation when pursued by the stoat. But the explanation that he attempts perhaps only adds to the mystery.

In a book concerning so wide a range of subject matter, errors are almost inevitable. There are statements in the work which are challengeable. Persistently throughout the chapter on bumble bees, the genus *Bombus* is mispelled *Bombex*, the author having averted by the substitution of a single letter the transformation of a bee into the silkworm *Bombyx*. Such a transformation has no reality, but many of the facts of nature—and the present volume can necessarily offer only a few of them—are only a little less wonder-arousing.

HERBERT F. SCHWARZ.

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[*] Those readers of NATURAL HISTORY who make a habit of preserving their copies may be interested to refer back to the issue of May-June, 1925, Vol. XXV, pp. 276-281, wherein an illustrated article by William M. Savin appears on *Pronuba* and the yucca under the title of "A Remarkable Friendship."

PREHISTORIC ROCK PICTURES IN EUROPE AND AFRICA

- - - - - - - - - - by Professor Leo Frobenius

Museum of Modern Art, New York City, $1.85

THE subject matter of this little book falls into three parts. In the first Professor Frobenius himself gives a brief account of the rise and development of prehistoric art studies and especially of his own prolonged activities in this field. The second part, by his collaborator, Mr. D. C. Fox, locates the principal European and African art centers and briefly describes by text and illustrations the outstanding features of each. The third section is simply a catalogue of the exhibits shown during the month of May at the Museum of Modern Art in New York City.

As a whole the book, though sketchy, is both readable and interesting, as well as in the main scientifically sound. The chief fault is that some of the pictures described in the text are not illustrated. Then too, the omission of a much needed bibliography mars an otherwise suitable introduction to the subject.

N. C. NELSON.

SPANISH TRAILS TO CALIFORNIA

- - - - - - - - - - - by T. De La Rhue

Caxton Printers, Ltd., $2.50

THE most difficult of all forms of fiction is the historical novel. When history abounds in strong psychological situations and dramatic sequence of events, it seems incredible that the number of first-rate novels of this type is so small. One has the strongest sympathy with Dr. De La Rhue for feeling impelled to dramatize the extraordinary scenes which took place during the Spanish colonization of the southwestern United States. The history and the very atmosphere of the country demand the highly flavored boldness of treatment which Dr. De La Rhue applies to his novel.

There is, however, an unfortunate quality in *Spanish Trails to California*. It would almost approach spuriousness, did we not know that the author was steeped in the lore and tradition of his country. To the reviewer it would seem that if the romantic style were toned down, the events themselves would give the effect the author desired. It would appear to him likewise probable that the hypothetical historical occurrences by no means improve on the factual background of Spanish colonization in the New World.

G. VAILLANT.

SCIENCE IN THE FIELD AND IN THE LABORATORY —*Birds from New Guinea—Bimini Expedition—Pursuing the Electric Eel—Tropical Fish Exhibit—New Spider Species—Honors*

Birds of the Archbold New Guinea Expedition

About 3500 bird skins representing 300 species make up the collection secured by the Richard Archbold 1936 Expedition to New Guinea. They are the result of the first systematic work in 65 years in the region of the lowlands about the Fly and Wassi Kussa River in South New Guinea.

Dr. A. L. Rand who returned from the expedition in April and spent the next two months in San Diego with Mr. Archbold preparing for next year's trip to New Guinea, is working on a report of the expedition.

The heavy rain forests of the upper Fly, 600 miles from the coast, the swamps of the middle Fly, and the savannas of the lower Fly and the Wassi Kussa were all visited. In this part of New Guinea, nearest Australia both geographically and faunally, four Australian species, a fruit pigeon, a bustard, a little bittern and a flycatcher were found for the first time in New Guinea, and an Aru Island kingfisher was also added to the New Guinea list. Series of a wood shrike and two species of finches not represented in American museums were secured. Adequate species of many of the little known South New Guinea species will yield a number of new subspecies and form a basis for the working out of a number of groups.

The range of many New Guinea species has been greatly extended and a hasty survey of the collection shows that some interesting cases of distribution are involved.

In addition to the collecting, many notes on habits, nests and breeding were secured. The most important of these observations perhaps concern the birds of paradise. With the black crow—one of the most unspecialized birds of paradise—it was found that both the male and female take an equal share in nest duties; and the male of the specialized king bird of paradise was found to select a display tree from which other males were excluded.

This bird collection helps fill a big gap in the ornithological knowledge of New Guinea and forms another important mass of material on which to base the study of distribution in New Guinea which is one of the aims of the Archbold Expedition.

Seeking a New Species of Bird

Dr. James P. Chapin of the Department of Birds who on June 18 flew from Brussels to the Belgian Congo to try to discover in life the strange, new pheasant-like bird which he found in the Belgian Museum and named *Afropavo congensis,* sends from the field an encouraging report of progress.

Thanks to the cooperation of government officials and the assistance of native hunters whom he employed over 20 years ago, Chapin was taken at once to the forest in which the bird is reported to live, and we hope soon to hear of the success of his search.

Insect Gifts and Purchases

Through the kindness of a number of its friends the Museum was recently enabled to purchase the J. D. Gunder collection of butterflies which includes about 28,000 specimens. This collection was accumulated chiefly from the western states and is particularly rich in aberrations and varities.

Pursuing the Electric Eel

A few years ago, C. W. Coates of the New York Aquarium undertook the organization of a research on the electric eel in the aquarium, particularly on its electric properties. A number of valuable observations were made and the cooperation of several other institutions was enlisted, but the difficulty of importing these large and dangerous fishes and the chance of differences in reaction caused by captivity in tanks, made it advisable to send an expedition to their native habitat. Accordingly Dr. Richard T. Cox, Mrs. Cox and Robert S. Matthews, sailed on February 1st for Para (Belem), Brazil, to study the habits of the electric eel. Field observations confirmed and amplified the Aquarium findings and much material, both preserved and alive, was brought back for further experiments. The Museum received valuable preserved and skeletal material of Brazilian fishes, particularly of the families *Characidae* and *Gymnotidae* upon which the Department has been doing special work for some time.

The expedition which returned the latter part of April, was conducted under the auspices of the Simon Baruch Foundation, the New York Aquarium, New York University and the American Museum of Natural History; received many aids and courtesies from the people of Para, for which the party was very grateful.

Boy Discovers New Spider Species

Last spring Manuel dos Passos, the young son of the Entomology department's Research Associate, captured several spiders near his home in northern New Jersey. Subsequent examination at the Museum revealed that the young amateur had brought to light some specimens of a species heretofore unknown to science.

The Case of the Tropical Fish

At the Tropical Fish and Terraria Exhibit (September 10, 11 and 12) 150 tanks and 150 pairs of fish will be on view shown by thirty exhibitors who are competing for the award of medals and the grand prize of the Wright Cup which must be won three years in succession. Mr. Larry Shaw won the last two years and will be on hand this year to attempt to secure the Cup permanently. It may be of interest to note that the Cup is given by Mr. Willard Huntington Wright who builds mystery stories around Philo Vance under the pseudonym of S. S. Van Dine.

Lerner—Bimini Expedition

Francesca LaMonte, Miles Conrad and Ludwig Ferraglio spent the month of July on Bimini, Bahama Islands, with the Department's Field Associate, Michael Lerner, studying the local fishes particularly the marlin. The expedition was made possible through the generosity of Mr. Lerner. Through the use of three cabin cruisers with big gamefishing equipment, a glass-bottomed skiff, diving helmets, and the usual equipment of handlines, fish traps and nets, the expedition was able to secure a remarkable series of observations on the body form of the blue marlin; a large series of one of the small Pomacentrids; young specimens from the gulfweed, and brains, reproductive organs and skeletal material of the marlin.

Also secured were a valuable and large collection of underwater photographs and moving pictures, many of which are in color, and a series of color sketches and paintings. These will provide data for a future exhibit in the Museum's Hall of Fishes of the World.

Through the kindness of the Colonial Secretary at Nassau, all the expedition equipment was allowed duty-free entrance at Bimini, and throughout the stay many courtesies were received from the Acting Commissioner there and the other residents of the island, particularly the local Boy Scouts who made a collection of lizards and snakes.

Goldfish Eater to Grace Live Fish Exhibit

A new strain of guppies with tails and fins of vivid peacock color, and large cichlids that have to be fed fourteen live goldfish apiece every day, are among the features of the 46th Annual Tropical Fish and Terraria Exhibit to be held in the Museum on the 10, 11 and 12 of September. The cichlid will appear to the layman to be most unusual at feeding time, for he is very dainty in his eating habits. He does not swallow the goldfish without preparation. As the hapless victim is drawn into the jaws of the cichlid, all scales are stripped off and pass out through the mouth into the surrounding water. The goldfish thus arrives at its destination—the stomach of its captor—in an easily digestible state.

Education News

Motion pictures, lectures, and trips through the Exhibition Halls of the Museum make up the calendar for school children this fall under the wise guidance of the Museum Department of Education. Children will enjoy learning of the boys and girls of other lands; how the Indians fought their Silent Enemy—Hunger before the advent of the White Man; what New York was like in the days of Peter Stuyvesant; the way the Canadian fir-trapper works in the northern woods; about the lives of animals—both in the jungles and in our own backyards. More advanced work is planned for High School and College students. Courses for the latter, are provided in cooperation with New York University and the City Colleges, for which regular academic credit will be given. All of these lectures and courses are free. Perhaps the most attractive of the plans for fall is the series of Saturday afternoon programs of motion pictures to be held in the Museum Auditorium at 2:00 P.M. Admission is free. The varied topics include the big-game animals of Africa—taken by the late Martin Johnson; a film of real Indian life taken in the eastern woodlands of Canada; the story of Daniel Boone; fossil hunting in the Gobi Desert; and the story of the dam-building Beaver.

Honors and Awards

Clark Wissler, Dean of the Scientific Staff, was elected Vice-President of the American Association for Adult Education. He is actively cooperating with this Association in a study of Museum educational activities.

* * *

On May 13th the centenary of the birth of Daniel Garrison Brinton was celebrated in Media, near Philadelphia. Brinton was one of the founders of American anthropology and generally regarded as its most brilliant scholar. The Museum was represented at this celebration by Dr. George C. Vaillant, and an address on Doctor Brinton and anthropology was given by Dr. Clark Wissler. The celebration was attended by delegates from many institutions representing various fields of science.

Doctor Brinton began his scientific career as a specialist in medicine, served in the medical staff of the army during the Civil War, and later gave considerable attention to the development of scientific medicine, believing that diagnosis should be reduced to a science. Some time after the Civil War he took up the study of anthropology, was appointed to a position in the Academy of Natural Sciences in Philadelphia, in 1884, and two years later Professor of American archaeology and linguistics in the University of Pennsylvania.

NOVITATES

No. 928. South American Bees. By T. D. A. Cockerell.
929. Records of African Bees. By T. D. A. Cockerell.
930. Studies of Peruvian Birds. No. XXVI. Notes on the Genera *Agriornis*, *Muscisaxicola*, *Myiotheretes*, *Ochthoeca*, *Colonia*, *Knipolegus*, *Phaeotriccus*, *Fluvicola* and *Ramphotrigon*. By John T. Zimmer.
931. American Muscidae—IV (Diptera). By C. H. Curran.
932. The Morphology of Wardite. By Frederick H. Pough.
933. Birds Collected During the Whitney South Sea Expedition. XXXIV. The Distribution and the Migration of the Long-Tailed Cuckoo (*Urodynamis taitensis* Sparrman). By Cardine Bogert.
934. *Syngnathus walcotti*, A New West Indian Pipefish. By J. T. Nichols.
935. *Trichopepla klotsi*, A New Species of Pentatomid from Wyoming (Heteroptera). By Herbert Ruckes.
936. New American Spiders. By W. J. Gertsch.
937. New Insectivores, *Elephantulus* and *Crocidura*, from Angola, Africa. By John Eric Hill and T. Donald Carter.
938. A New Species of Hesperiidae, and Notes on Others, from Panama. (Lepidoptera-Rhopalocera). By E. L. Bell.
939. Birds Collected During the Whitney South Sea Expedition. XXXV. Notes on New Guinea Birds. II. By Ernst Mayr.

BULLETIN

Volume LXXIII Art. VII—The Sense Organs Involved in the Courtship of *Storeria*, *Thamnophis* and Other Snakes. By G. K. Noble.
" LXXIII Art. VI—Catalogue of the Meteorites in The American Museum of Natural History, as of October 1, 1935. By Chester A. Reeds.
" LXXIII Art. V—Anatomy of the Head and Pelvic Fin of the Whale Shark, *Rhineodon*. By Robert H. Denison.

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there was not quite room enough for us both during the night. I had, therefore, to tell him that while I closed at five, the balcony was at his disposal for the night. But he preferred the forest and disappeared until the following morning. Then, sometimes as early as sunrise, I heard his padding footsteps on the balcony floor and, opening my door, found his pathetic, cowering figure waiting for food and the shelter of the under side of my bed. The slanting rays of the sun reached him there and with their aid I photographed José in his post-breakfast nap. Sleep and more sleep was his chief desire. At times he slept so soundly that he seemed to have expired. At the best he showed little interest in life and it was clear that he was daily losing his grip on it.

His last visit was made March 31. For the succeeding two weeks bananas were always awaiting him on my balcony but they were uncalled for. How his end came we will doubtless never know. Probably he crawled into one of his forest retreats to sleep and never awoke. We should like to have marked the resting-place of his battle-scarred body with some tribute to the intelligence which led him to accept favoring changes in his environment and place his trust in the good-will of man.

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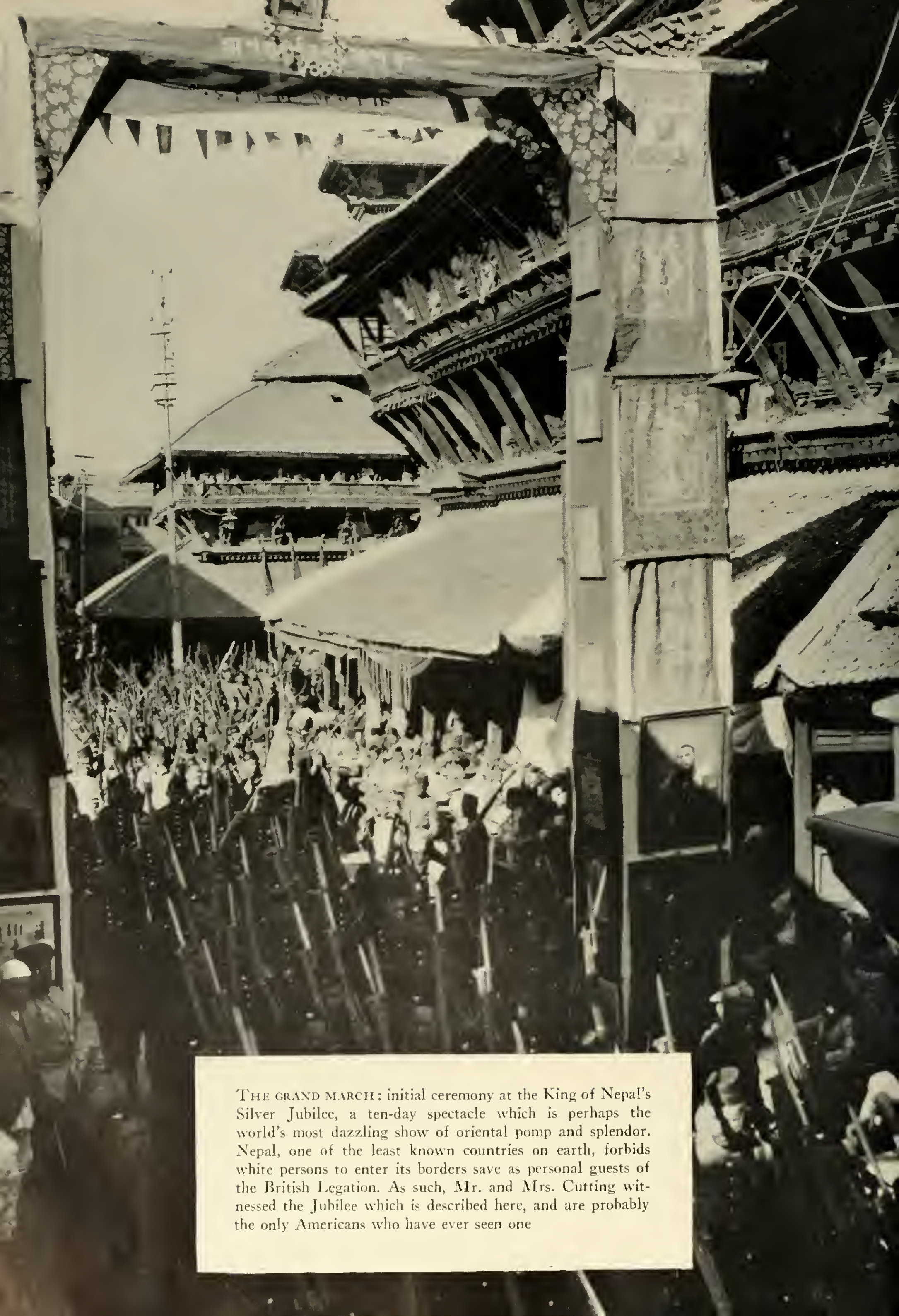


THE GRAND MARCH: initial ceremony at the King of Nepal's Silver Jubilee, a ten-day spectacle which is perhaps the world's most dazzling show of oriental pomp and splendor. Nepal, one of the least known countries on earth, forbids white persons to enter its borders save as personal guests of the British Legation. As such, Mr. and Mrs. Cutting witnessed the Jubilee which is described here, and are probably the only Americans who have ever seen one

JUBILEE IN NEPAL—*A journey into the mountain fastness of a country visited by few white people to view one of the East's most spectacular pageants*

By C. SUYDAM CUTTING

Trustee, American Museum of Natural History

THE mountain state of Nepal is one of the least known countries of the world. To glimpse its King is to lay eyes on a personage who is publicly beheld only at rare intervals, and to witness the Twenty-five Year Jubilee of his accession is to stand spellbound before a spectacle of such splendor as can be seen perhaps nowhere else in the oriental world.

Invitation to Nepal

Nepal, an absolutely independent kingdom, exercises its right to a total exclusion of foreigners except under very special conditions. Its isolated position on the rugged southern border of the Tibetan plateau is largely responsible for its never having been conquered and its suspicion of foreigners. Nepal has fought with the Tibetans, Chinese and British, but it has never suffered any dangerous invasion except at the hands of the British in 1816 when the treaty was drawn up permitting a permanent British legation at the capital, Katmandu. The Minister retains the privilege of inviting foreigners to stay with him, but their names must first be presented to the Nepalese government. And so suspicious of foreigners are the Nepalese that neither the Minister nor his guests may at any time go beyond the confines of the great valley where Katmandu is situated. Our visit was made possible by the kind invitation of our two great friends, Lt.-Col. and Mrs. F. M. Bailey, the British Minister and his wife.

Starting from Lucknow, we bumped for twenty-five blistering, dusty hours along the narrow-gauge Bengal Eastern Railroad, and at nightfall reached Raxaul at the frontier of Nepal. As guests of the Legation, we were met here by two Gurkhas who were to act as our permanent guard and escort to the capital, Katmandu, two days beyond. The large tents which the British Legation has maintained at Raxaul for its guests ever since the recent earthquake destroyed its bungalow, seemed to have all the comforts of home after the railroad journey. There was hot water for baths and solid iron beds. Yet the night was disturbed by the shrieking of extra trains bringing bands of pilgrims for the Hindu annual Holy Week which coincided with the Jubilee, and by their endless chanting and banging on tin pans.

Next morning we made our way through the throngs to the Nepalese railroad station and began a thirty-mile journey across the Terai, or plains. This took us through one of the finest big game tracts in Asia, and what a unique journey it was! Boxcar after boxcar had been added to the train, each filled with compressed human bodies, people of both sexes and all stages of decrepitude, with their blankets, food and cooking utensils.

At the small town of Amlekhjang we disembarked from our crowded second class carriage and proceeded by lorry and motor provided by our escort over the next leg of the trip, a distance of 27 miles. We threaded our way through endless masses of pilgrims, most of whom were walking, and passed many temporary rest camps under the shade of trees.

Over two passes

At a town called Bhimphedi a pass abruptly brought the road to an end, and there, ready and waiting, were ponies and coolies. About a thousand feet above and at an altitude of perhaps 7000 feet (the road to Katmandu has never been surveyed) we dismounted at the town of Sisagarhi. Here on a ridge the Maharaja of Nepal has a guest house in which we were fortunate to be able to pass a comfortable night, away from the pitiful pilgrims, who were obliged to remain in the valley.

On the next and last day, another pass of about 7000 feet entailed a seven-hour march on ponies, or, if preferred, on dandies carried on the shoulders of four to six men. From the summit of this pass we saw the first magnificent view of the valley and Katmandu, our objective, 2500 feet below. The novelty and charm of this valley were from this moment increasingly apparent.

Near the foot of the pass a proper road opens up, and we again changed to motor cars and lorries for the final run of 16 miles to the British Legation. The roads in this valley are very limited and do not lead beyond, but cars are nevertheless exceedingly popular among the gentry. They are surprisingly plentiful and the types range from two-seated sport models to heavy saloons. Each car has been carried over two passes on human backs. The trail is extremely bad and steep in many places, but with unlimited porters the task of transporting the cars is not so difficult as might be imagined.

Buddha's birthplace

Passing through the small villages, one is first aware of being in a new civilization. Here Hindu culture of a thousand years ago persists, uncontaminated by either Moslem or Occidental influence. The plain is studded with several magnificent shrines, the larger of which rear their heads above the entire landscape. Although the people of Nepal come from both southern and northern Asia, they live together in complete unity and practice both Hinduism and Buddhism without a clash. The original religion of the country was Buddhism, and no wonder since a small site in southern Nepal called Rummendei is forever immortalized as the birth-place in 536 B. C. of the Gautama Buddha. Slowly, with the steady influx of people from India, Hinduism gradually superseded this religion until it became the dominant faith.

The houses are all strongly built of either wood or stucco and the better ones often display gilt metal ornaments at the tops of their slanting roofs. One is impressed with the grandeur of the massive white palaces of the nobles, gleaming through the greenery of their luxuriant gardens and sometimes displaying Corinthian columns. Everywhere one is conscious of cleanliness—in the lowliest city streets and throughout the countryside—a refreshing contrast to the usual conditions in southeastern Asia.

This superbly beautiful valley is landlocked by mountains, among whose northern snow-capped crests rise both Everest and Kangchanjanga. Picture in such a setting a vast, beautiful cultivated truck garden, approximately 180 square miles in area, and you have the great valley of Katmandu. The two main industries are lumber (from the Terai) and cardamom, or ginger, from the valley. Once brasswork was exported, but today this industry has deteriorated. Everywhere one sees picturesque groves of giant rhododendrons, cherry, plum, mangoe, banyan and white pine; and the countryside is lovely with largestrina and the broad Nepalese rose of the rambler variety. Besides agriculture large areas are given over to lush grazing where herds of sheep, goats, and cows wander about amidst flocks of chickens and countless ducks.

Nepal is one of the great game countries of the world, and the Maharaja himself is a most intense hunter. The best shooting grounds are the Terai where Indian rhino, sambhur deer, swamp deer, black buck, leopard, cheetah, and tiger abound. All shooting is done from elephants, and the Maharaja's expeditions are organized on an enormous scale. One hundred elephants may be sent out to locate tiger, and an elaborate field telephone system informs the Maharaja of activities and enables him to speed to the proper locality as soon as an animal has been located. His annual bag for tigers amounts to forty or more.

Aside from sport, Nepal offers much in the study of birds, plants and animals; but unfortunately, as white people are not allowed about, little scientific research has been done. The presence of foreigners within the borders of Nepal causes immediate suspicion, and scientific objectives are apt to be regarded merely as a subterfuge to conceal espionage. Nepal and Tibet have resisted the conquests of China, England and Russia, and have watched the steady encroachment of their borders. The old adage that "Where white man goes, so follows an army" is like a creed and is the basic reason for closing their frontiers. Yet, with all this feeling, should one enter under the correct auspices, the greatest courtesy is always shown. From the highest officials right down, one is given a hearty welcome and is treated with great distinction.

Wealth without power

The Nepal government is a feudal, monarchial state, comprising a special class of highly distinguished nobles, with the kings reigning by heredity. In times past these kings have held much power, but it has slowly waned as their prime ministers, with the title of Maharaja, usurped it. At present, the King, though greatly revered and almost deified, has been reduced to a mere puppet: a great inviolable figurehead, enormously rich, living in a magnificent palace, yet shorn of power. And at any military function, as we were to see, his grandeur, despite his aura of holiness, is but borrowed plumes from the great Maharaja at his side who, mounted on a white steed, wears no aspect of piety or holiness, but that of a warrior potentate. The King on such occasions arrives in his motorcar with no pomp, his bodyguard being barely represented, and he is similarly hustled off after the display without being permitted to speak to anyone.

Politically, Nepal has been rife with plots and counter-plots that often have led to violence and bloodshed. The Kings, being held sacred, have not been embroiled, but the Maharajas, or Prime Ministers, have been the center of the bitterest kind of intrigue and there have been countless murders. Their office is hereditary through the eldest of all the sons and nephews of any incumbent, and brothers and cousins have plotted relentlessly against one another to gain supreme power. The present Maharaja, whom we were to meet in the coming spectacle, has proved himself an intelligent, fair, hard-working, and powerful figure. No intrigues have dared dispute his position, and he is recognized as their leader by all the nobles. His full title is: Lieutenant General His Highness (Ojaswi Rajanya Projjwala Sri Sri Sri) Maharaja Joodha Shumshere Jung Bahadur Rana G. C. S. I.; G. C. I. E.; Honorary Colonel of all the Gurkha Rifle Regiments of the Indian Army; Prime Minister and Supreme Commander-in-Chief of Nepal.

Early one brilliant afternoon, the "Distinguished Visitors" as the Nepalese characterized us, started out with the British Minister, Lt. Col. F. M. Bailey, and his wife to witness the official opening of the great Silver Jubilee. Leaving the Residency, which was elaborately decorated with bunting of many colors, our car sped for a mile and a half to a vantage point in the heart of the city which had been allotted by the Government. Here a long balcony shaded by an awning had been prepared from which the coming procession could be viewed.

The narrow streets were lined with ornate houses in whose windows and balconies crowded the excited masses in their brilliantly colored costumes, their faces radiant with expectation. The dark, narrow streets were also congested with those of the lower class, milling around, but kept within limits by police armed with business-like sticks.

Mounted on elephants

Soon the procession came into view, and, behind small units of infantry and lancers, the King and the Maharaja, each on his own elephant, rode majestically between the excited throngs. The King was caparisoned like a character from the Arabian Nights. Alone in a magnificent howdah, he was dressed in smart jodhpurs and longish coat tailored in Nepalese style. He was crowned by the famous helmet of pearls, teardrop emeralds, huge diamonds, renowned rubies, and a beautiful bird-of-paradise plume in natural colors. Besides these he wore on his left breast a few of the choicer gems that had once belonged to the infamous Nana Sahib of Indian Mutiny fame. The King is considered a good man, well educated and able to speak English, though at the latter he can have had little practice, considering his secluded life.

The Maharaja wore a military khaki suit and helmet similar to the King's except that his paradise plume was a little shorter, the teardrop emeralds more numerous. Then came the princes, generals, nobles, great and small, and finally the Gurus or high priests. Many of the famous helmets were pointed out to us, but the emeralds were less and less conspicuous as the parade progressed.

Military demonstration

Another day brought the military phase of the demonstration, with two grand reviews in the great rectangular parade ground in the center of Katmandu. As before, the "Distinguished Guests" motored to view the first of these. The troops formed a huge rectangle in the square, in the center of which stood the concrete platform or plinth built around the historic tree where the famous Maharaja Jan Bahadur had been wont to hold open air tribunals.

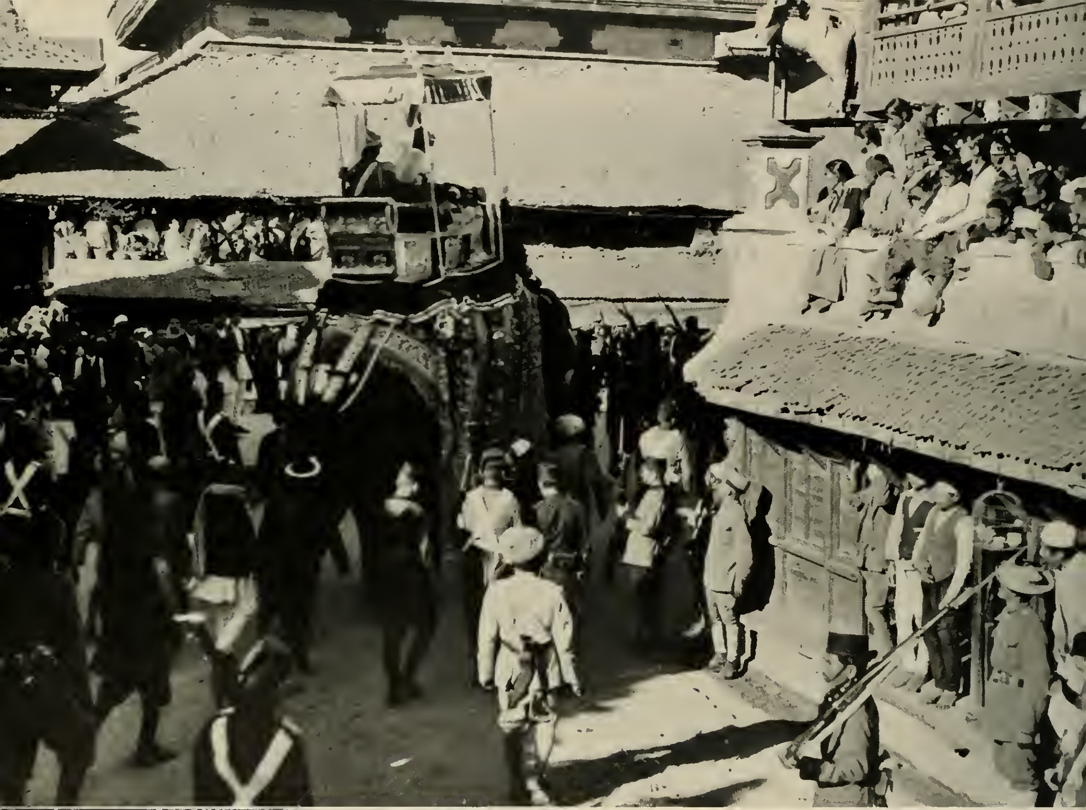
Finally the Maharaja in full uniform appeared in the distance. He galloped briskly up to the plinth, followed by his bodyguard, and took the salute of high generals who were waiting. Then he came forward and shook hands with the Baileys and their guests, all in a manner of great cordiality.

When formalities were resumed, the King's motor car appeared in the distance, followed by a part of his mounted bodyguard. He was accompanied by his three eldest sons who, like the Maharaja, came directly to the plinth, formally shook hands, then without speaking to anyone, retired to a row of chairs specially set aside.

This feature of the Jubilee began and ended with a prolonged volley—a real *feu de joie* of 12,000 rifles and a number of field guns from every quarter of the rectangle. Nepal's great pride, her army, is composed of the famous Gurkha troops and numbers around 40,000 to 50,000 men, a vast force for so small a state which needs fear war of aggression from no quarter. The officers belong to the nobility and are born to their position. It is possible, indeed, for one to be born a general, and we saw some at this exhibition who did not appear to be even twenty years old.

With the final volley, a cloud of blue smoke permeated the vast parade ground, and when the echoes died away we waited until the Maharaja, surrounded by generals in splendid uniforms and decorations, ceremoniously escorted the King down three steps to his motor.

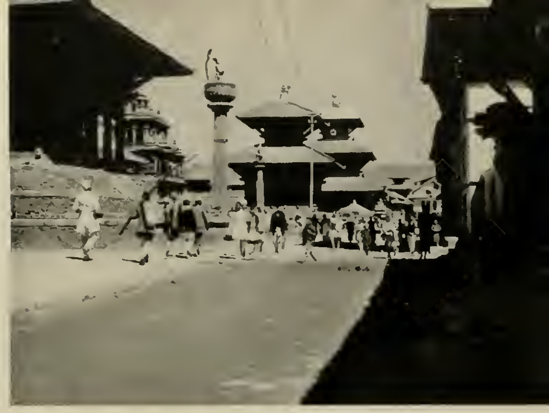
A few days later, the militia again had their in



(Above) A RARE PAGEANT OF STATE in Nepal: the appearance of the King before his subjects, caparisoned like a figure from the Arabian Nights, in the spectacular Silver Jubilee. More god than ruler, the King is fabulously wealthy and has few official duties. He speaks English but is rarely allowed to converse with foreigners. Real rulers of this feudal realm are the Maharaja and the nobles

(Left) ROUTE ONE to the Capital, Katmandu: the road followed by the author and by countless devout Hindus whose annual pilgrimage coincided with the Jubilee. Over two high passes on this trail porters have carried the numerous automobiles that are in use in Nepal

(Left) THE AUTHOR'S WIFE en route to view the Jubilee. Only by special invitation are foreigners allowed to enter Nepal

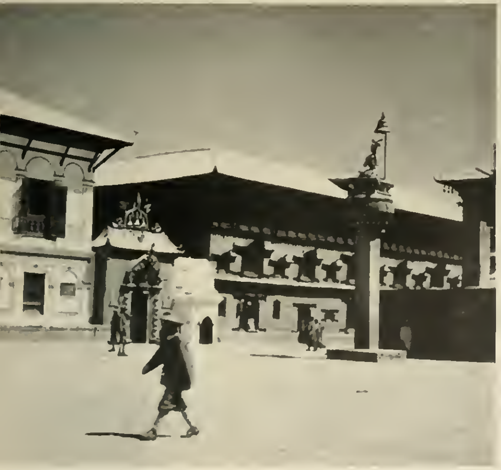


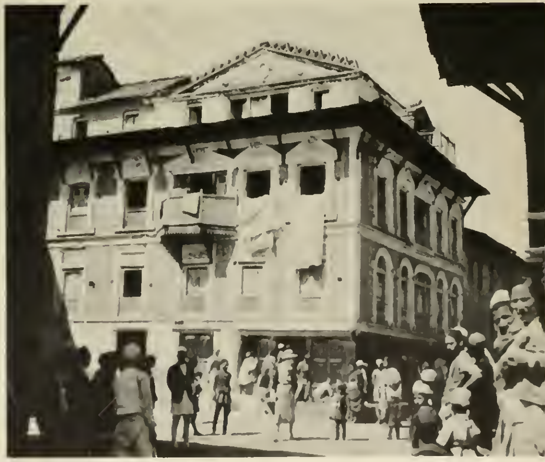
(Above) Mr. C. Suydam Cutting and Lt.-Col. F. M. Bailey, the British Minister, before the Residency, which reflects nothing of its remote Oriental setting

Clean streets are a distinguishing feature of Nepal, as seen below in Paten. Note the gold door and the pedestaled figure of an early Nepalese prince

Distinctive architecture and culture reminiscent of eighth century India survive in Nepal's fertile central valley, where Paten, shown above, is situated

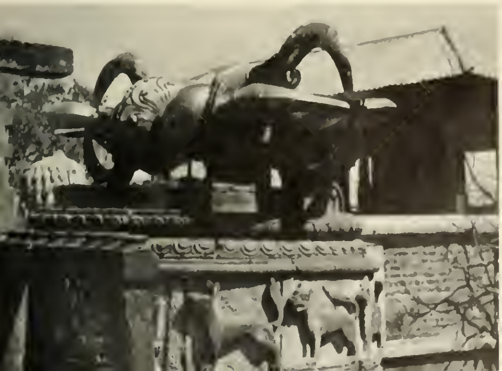
(Below) A street corner in Katmandu, the capital of the mountain kingdom. High ranges including both Everest and Kangchangjango guard the country

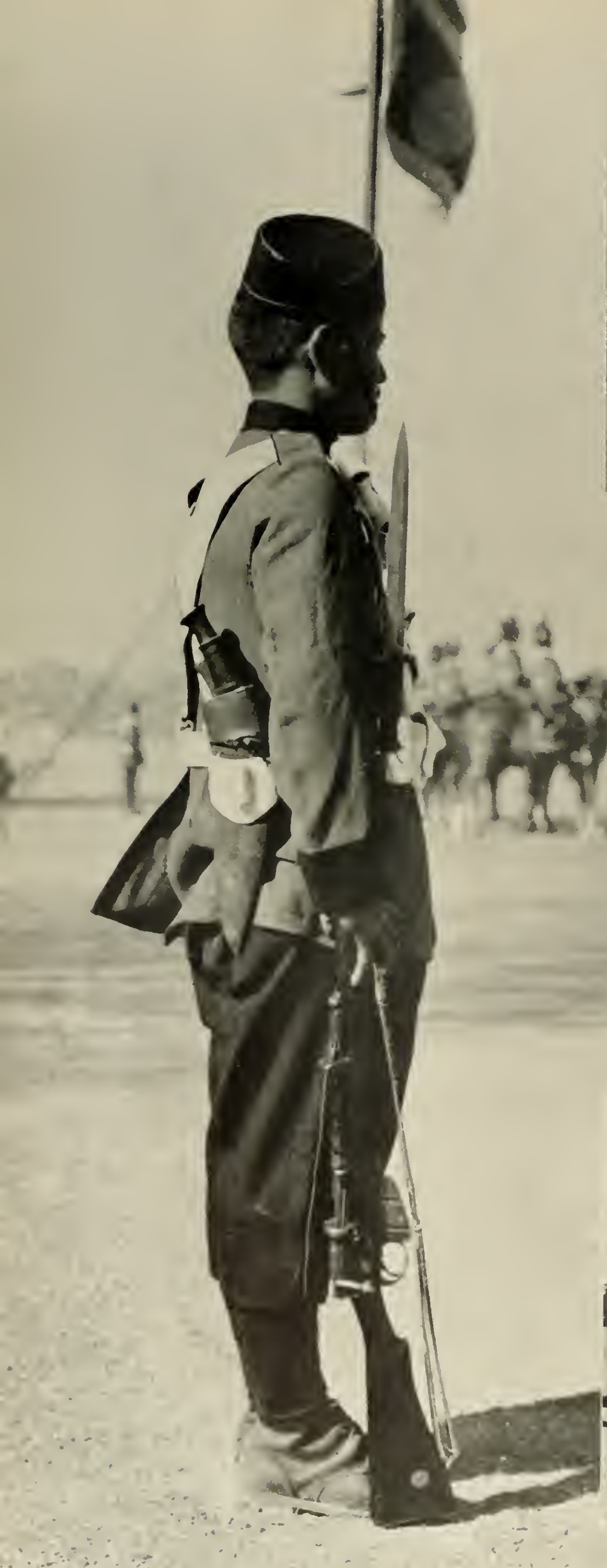




(Below) The largest Dorje or Thunderbolt in Asia: a Buddhist emblem. Both Buddhism and Hinduism are practiced in Nepal without discord. Though Gautama Buddha was born in southern Nepal, Hinduism has gradually become the dominant religion

(Below) The King and his bodyguard are seen entering the parade ground as the Jubilee gets under way. The celebration, which occurred in March and lasted ten days was one of the world's most impressive shows of Oriental splendor

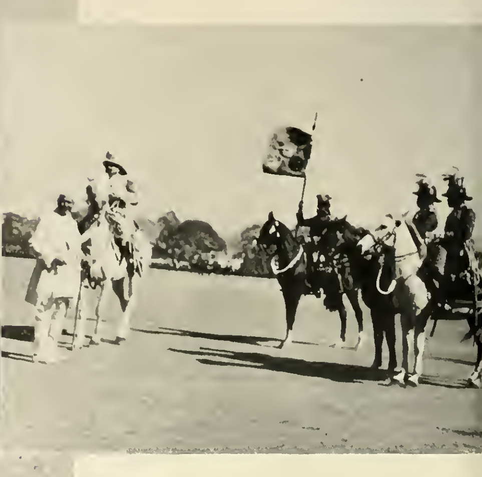




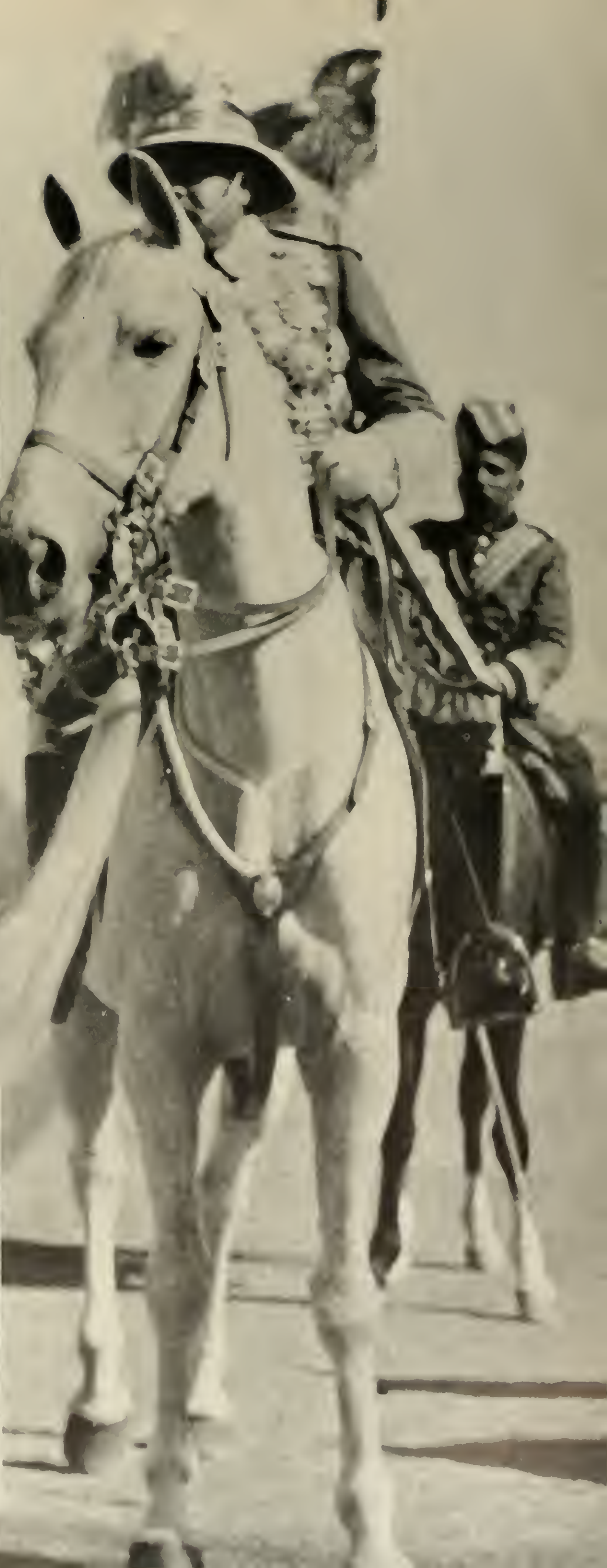
Nepal's army, her great pride, blares defiance 50,000 strong against aggression she need not fear

(Left) A Gurkha soldier: a member of a military body whose officers belonging to the nobility are born to their rank. A boy no more than 20 may be a general

(Below) Standing beside the mounted Maharaja is the Commander-in-Chief. Instead of a uniform, he is wearing white civilian clothes because he is in mourning

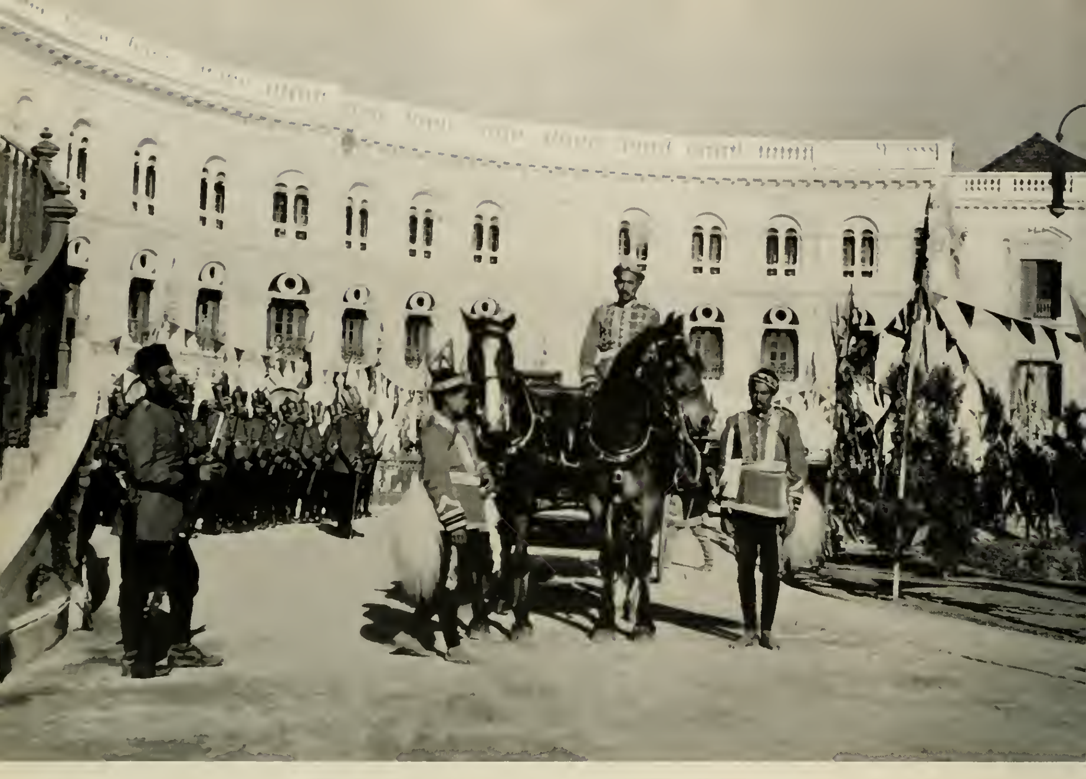


Invasions have often threatened Nepal, but seriously only by the British in 1816, when the existing treaty was drawn up



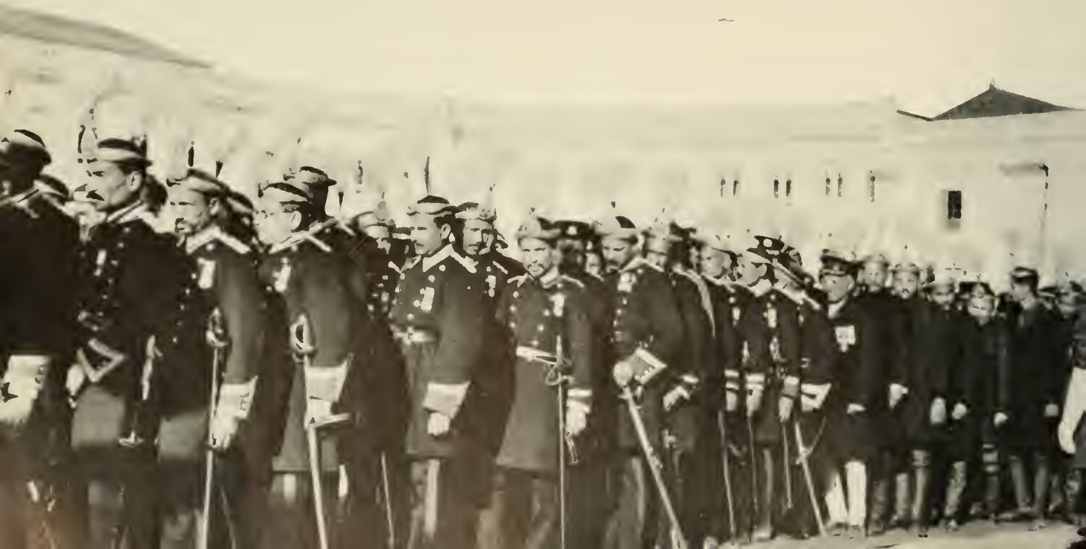
(Right) Lieutenant General His Highness (Ojaswi Rajanya Projjwala Sri Sri Sri) Maharaja Joodha Shumshere Jung Bahadur Rana G. C. S. I.; G. C. I. E.; Honorary Colonel of all the Gurkha Rifle Regiments of the Indian Army; Prime Minister and Supreme Commander-in-Chief of Nepal

(Below) The bodyguard of the Maharaja. Though his high office has formerly been the object of many plots and much bloodshed, the present Maharaja has proved himself an able leader and is not threatened by rivals



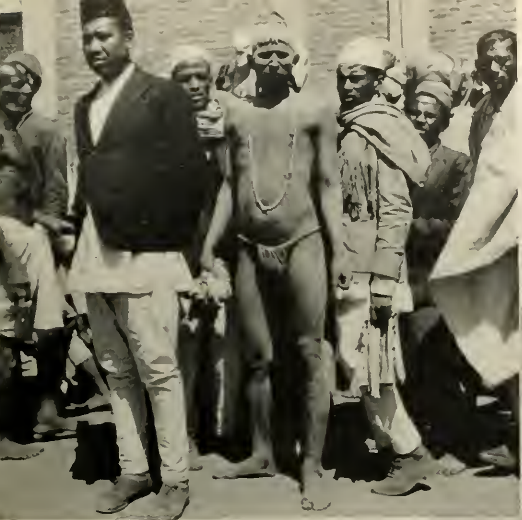
THE BRITISH LEGATION carriage entering the beautiful grounds of the royal palace for the most impressive performance of the entire Jubilee. This ceremony, of a religious nature, centered wholly about the person of the King and included a lengthy proclamation by the Maharaja extolling 25 years of progress in the realm

NEPAL'S FINEST: officers waiting to shake hands with their King at the palace ceremony. Here the social bars, so evident at the military demonstration, were somewhat lowered, and generals mingled with subordinate officers. Outside the enclosure the populace gathered in droves. Spectacular fireworks concluded the ten-day celebration

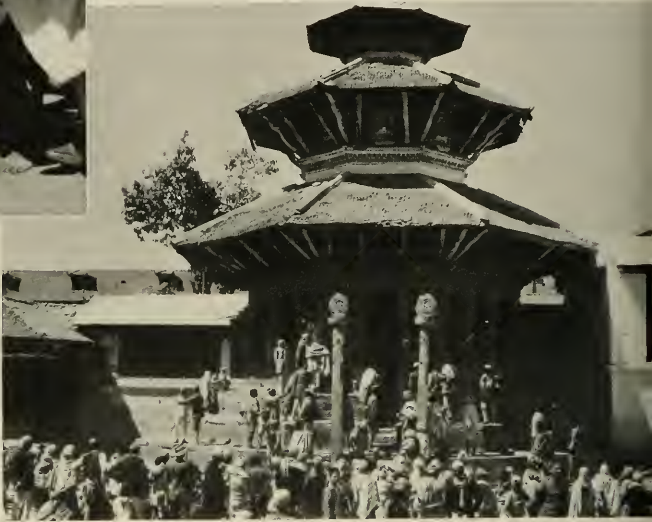


(Above) THE POWER behind the throne receives his monarch's guests: the Maharaja greeting army officers and government officials in order of their rank. When not engaged in state affairs the Maharaja is an ardent huntsman. An elaborate field telephone system informs him where the tiger is; mounted on elephantback, he shoots it

(Below) POMP AND CIRCUMSTANCE: here in his pagoda, surrounded by holy men decked in gold and jewels, the resplendent monarch receives distinguished visitors. The man in the gray Ascot topper is representing the British Legation. Nepal maintains its own legation in London where its representative lends exotic color to the garden parties of a better known monarch

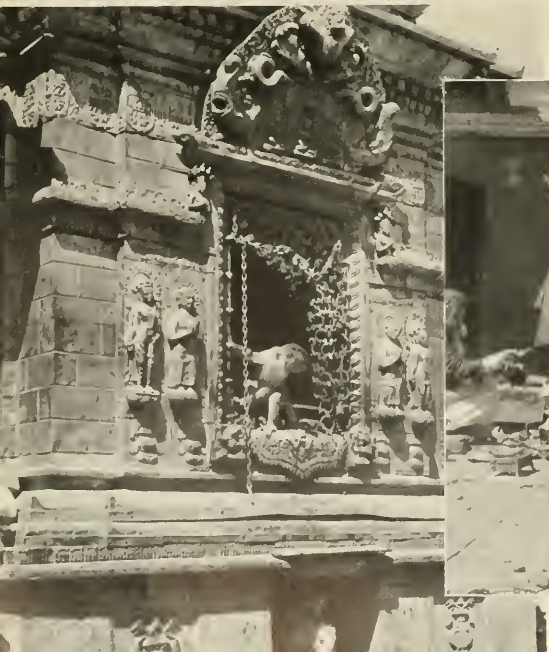


(Left) A FAKIR or Sadu: one of the many holy men who accompanied the great orthodox Hindu religious pilgrimage to Nepal coinciding with the Jubilee. He covers his almost naked body with ashes and, having vowed absolute poverty, lives on alms

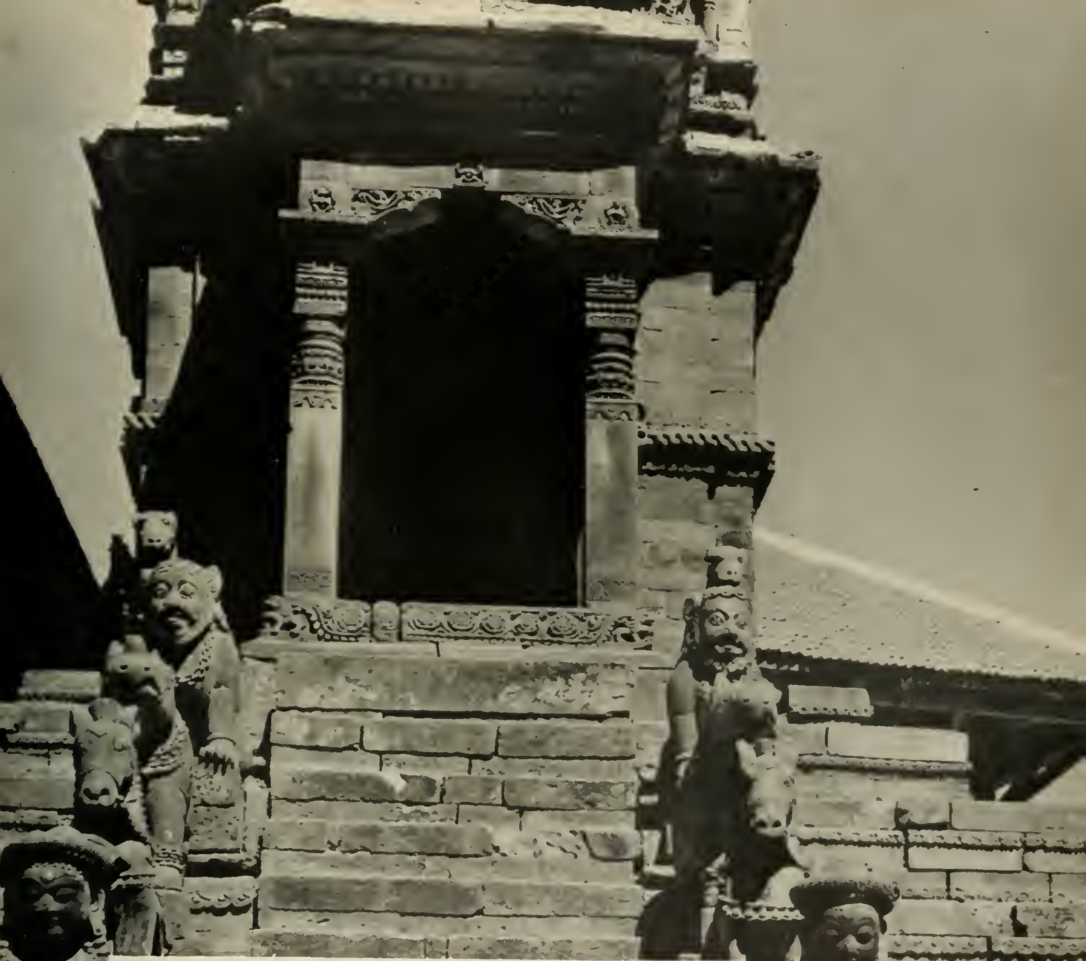


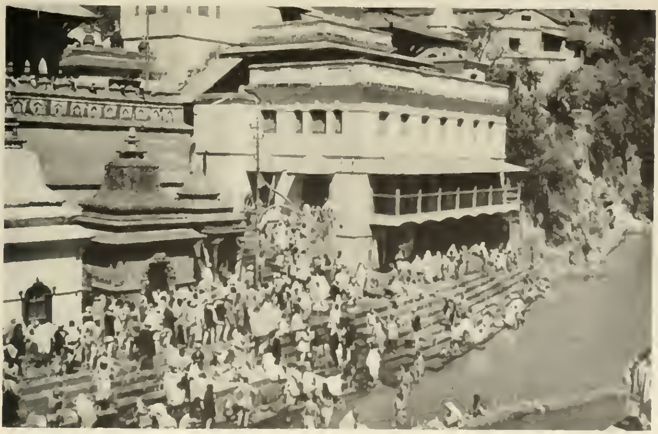
(Right) AT THIS TEMPLE in Katmandu the Maharaja distributes food to needy pilgrims, but many cannot be reached. If death overtakes a pilgrim en route to the shrine it is considered a guarantee of happiness in the future life

(Below) A MONKEY peers from a window at the top of Shymbanath Temple, one of the dominant places of worship. To reach it 340 stone steps must be climbed



(Below) A YOUNG MOTHER AND CHILD pose for the camera atop Shymbanath Temple, whither many of the 100,000 Hindu pilgrims climb. The poverty of the pilgrims is in great contrast to the display of wealth at the Jubilee





(Above) THE SACRED WATERS OF PASHPATI, where multitudes of devout Hindus cleanse themselves and dying kings were wont to come to die
(Large Photograph) THE TEMPLE IN PATEN

nings, when 12,000 troops, including all arms, passed in review. Sitting in a marquee tent with the same gentry who had sat on the plinth, we watched the troops march past for two solid hours. It was a somewhat tedious performance, for we had to rise each time a new regiment passed with colors unfurled. But we were entertained in amicable conversation by the Commander-in-Chief who sat close by and, like so many other Nepalese senior generals, spoke English. He was very proud of his troops, but on this occasion his dress showed nothing of his military position, for he had recently lost a near relative and was wearing Nepalese civilian white clothes.

The finale was the performance of a finely trained demonstration battalion that went through a complicated manual drill with rifles. The King and Maharaja superbly mounted reviewed this fine display, and the eager eyes of the natives in dense throngs were torn between the spectacle itself and the majestic figures of their rulers.

The King's day

The Jubilee's most impressive performance was perhaps one which centered wholly about the person of the King and was religious. Time after time we had driven past the gates of his huge palace enclosure to get barely a glimpse of the interior, but this day as we sped to the area where this performance was to be held, our curiosity was to be satisfied. Beautifully kept grounds lay on either side of the driveway. Encircled by the glaring eyes of the enthusiastic populace, an inner space had been roped off to accommodate half a dozen large marquees for the more elite. But unlike the military events, the social bars were lowered somewhat, and in our immediate vicinity there were not only generals of high rank but subordinate officers and many persons in civil service.

The King drove up in his gilded carriage to a point about one hundred paces in front of the great central staircase of his palace and proceeded at once to a small pagoda on the lawn surrounded by the Gurus or high priests, decked in cloth of gold and jewels. From this point he heard the following proclamation, read by the Maharaja:

"Your Majesty:

On the auspicious occasion of the celebration held in honor of the Twenty-Fifth Anniversary of Your Majesty's accession to the Throne of this sacred realm of Nepal, we are here today to tender our profound respects and hearty congratulations to Your Majesty.

This period of Your Majesty's reign has been, by the grace of God and Your Majesty's glory, such as to be worthy of being recorded in letters of gold in the annals of the country. Generally speaking, in the course of these twenty-five years the world has seen so much of trouble in almost every part of it that it might be said that there were scarcely any country left where there had not been some sort of commotion at one time or other, whether it be in the form of wars, of international jealousies, of internecine strifes and so forth. It is indeed a matter of no small significance that nevertheless our dear motherland should have been so free from any such turmoils as to be able to proceed quietly with slow and steady steps on the onward path of progress as time and circumstances permitted. Auspicious signs like these, casting as they do so much lustre on Your Majesty's reign and kingdom, stand as a dazzling testimony of Your Majesty's glory and the good fortune of the country.

Milestones of progress

Actions when well conceived and well directed ensure success, while those that are otherwise or are undertaken merely by way of aping others without due regard to one's own capacity are fraught with risk of serious consequences. Guided by this principle the Kingdom of Nepal has been moving forward making steady progress in every direction. Much has been done and achieved in improving the administration and the welfare of the country, during the last twenty-five years. In the military department the training and the equipment of the army have seen remarkable changes. The Military Hospital and funds such as Sainik Samarghya Chandrodaya and Sainik Drabya Kosh have been established and a system of retirement by age limit has been introduced, sati* and slavery have been totally abolished, while capital punishment has been replaced by life imprisonment as an experimental measure which has been extended by a further period of five years. For the people's benefit new forest lands have been opened at various places for colonization, and for their convenience in keeping up correspondence with those in India a restricted postal union has been effected with the Indian Postal Administration as a preliminary measure, and Exchange Offices have been established at various frontier posts. To improve home industries, mining, agriculture and forest produce, and to develop trade, the Development Board and the Agricultural and Geological Offices have been formed.

The welfare of the public is also being served by making it a rule to restrict extravagance in social functions and usages while for their civic well-being a Municipality has come into being. For the purpose of honoring the deserving, various Orders such as The Most Glorious Order of Rajanya, The Most Refulgent Order of the Star of Nepal, The Most Puissant Order of the Gurkha Right Hand, The Nepal Pratap Bardhak and The Distinguished Long Service Order have been instituted. It is not possible to enumerate everything that deserves mention. We may content ourselves by mentioning the Tribhubana-Chandra College, the Tri-Bhim Waterworks, the Sanatorium, the

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*The sacrifice of a widow on her husband's funeral pyre.

> Sundarijal Electrical Installation, the Ropeway, Road and Railway, the Telephone with its present extension to Sirha, all of which were formally opened by Your Majesty personally. Besides these there are other works of public utility such as the Tri-Chandra Canal, the Pathshalas and Schools, Hospitals and Ayurvedic Dispensaries, bridges and rest houses, the Janakpur Railway and what not.
>
> Some three years ago, by God's will, a serious calamity in the form of a disastrous earthquake befell us. But, nothing daunted by that disaster, the Bhukampa Relief Fund was set up and the disaster has been, so to say, converted into a veritable blessing in disguise by speedy relief and construction based wholly and solely on self-reliance and self-help, as the spacious new roads in the Capital testify.
>
> It is very gratifying to note that our relations with the neighboring countries remain as cordial and friendly as ever. Among them the happy relations with our traditional great friend the British Government deserve particular mention here. The help we gave them during the Great War, the Treaty of Friendship that was concluded with them in 1923 and the establishment of Legations in Nepal and London are some of the conspicuous instances which go to show that our happy relations with them are not only maintained but are growing stronger day by day.
>
> Providence has given us the very great pleasure of celebrating the Silver Jubilee of Your Majesty's reign. In honor of this happy occasion the outstanding arrears due to the Government as realizable balances coming under certain categories of the revenue, judicial, forest, audit and other departments aggregating to Rs. 6583320/—have been struck off; prisoners other than those convicted of murder, dacoity, robbery and other heinous crimes have been released, while the remaining convicts have been granted a general remission of four months in the term of their imprisonment.
>
> We devoutly pray to Shri Pashupatinath and Shri Guhyeshwari to prolong the happy reign of Your Majesty, to keep our dear motherland free from all harm and to guide it on the path of progress. May the good name of Your Majesty's Kingdom be resplendent with additional lustre and remain cherished in ever increasing glory!"

After hearing this proclamation, the King received those who had been allowed within the roped area, beginning with the army officers—the highest caste in the land—and proceeding in order of rank down through the civil officials. Although the Maharaja was ever-present, circulating about the pagoda in all his finery, this was definitely the King's day and the crowning feature of his Silver Jubilee.

Clear, brilliant weather, characteristic of March in this mountainous country, graced the ten-day period of the Jubilee celebration and likewise Nepal's important annual Holy Week, which coincided. One hundred thousand Hindus journey to Nepal at this time to worship at its famous temples, and the orthodox ascribe great virtue to the pilgrimage for their ultimate salvation. Being a long, hard journey, with nights coldish to the dwellers of the hot plains, some die by the wayside; but this is regarded, particularly by the old and infirm, as a glorious end to life. The Maharaja is supposed to feed the needy pilgrims, but he cannot reach all and it is only a nominal gesture.

The great throng was no ordinary multitude, as could easily be noted by the number of Sadus among them. These are very holy men, Brahmins, who cover their almost naked bodies with ashes and live by soliciting alms. There is no room in the city for such an influx, and it is fortunate that about the temples situated outside, the pilgrims can find ample room to eat, sleep and live in the many lovely groves of trees, which they end by utterly defiling.

Fireworks

The end of the Jubilee was a grand finale of fireworks attended by multitudes. For once the many motorcars in Katmandu were in evidence, as all who had them drove down and parked in front of the show. Here the public were not allowed, but the cries coming out of the darkness revealed how many people were massed beyond. Rockets predominated, but of colored fire and Roman candles there were some ingenious varieties. The imaginations of the inland natives were doubtless strained by a fireworks battleship that attacked a fort, but they rejoiced later in recognition of an elephant with a mahout that actually walked forward several steps.

Lt.-Col. Bailey, a scholar and naturalist, and his wife made every day of our visit delightful. We were afforded every opportunity to visit the places of historic interest in the valley, and there were many diversions, as lawn tennis, riding, and snipe shooting.

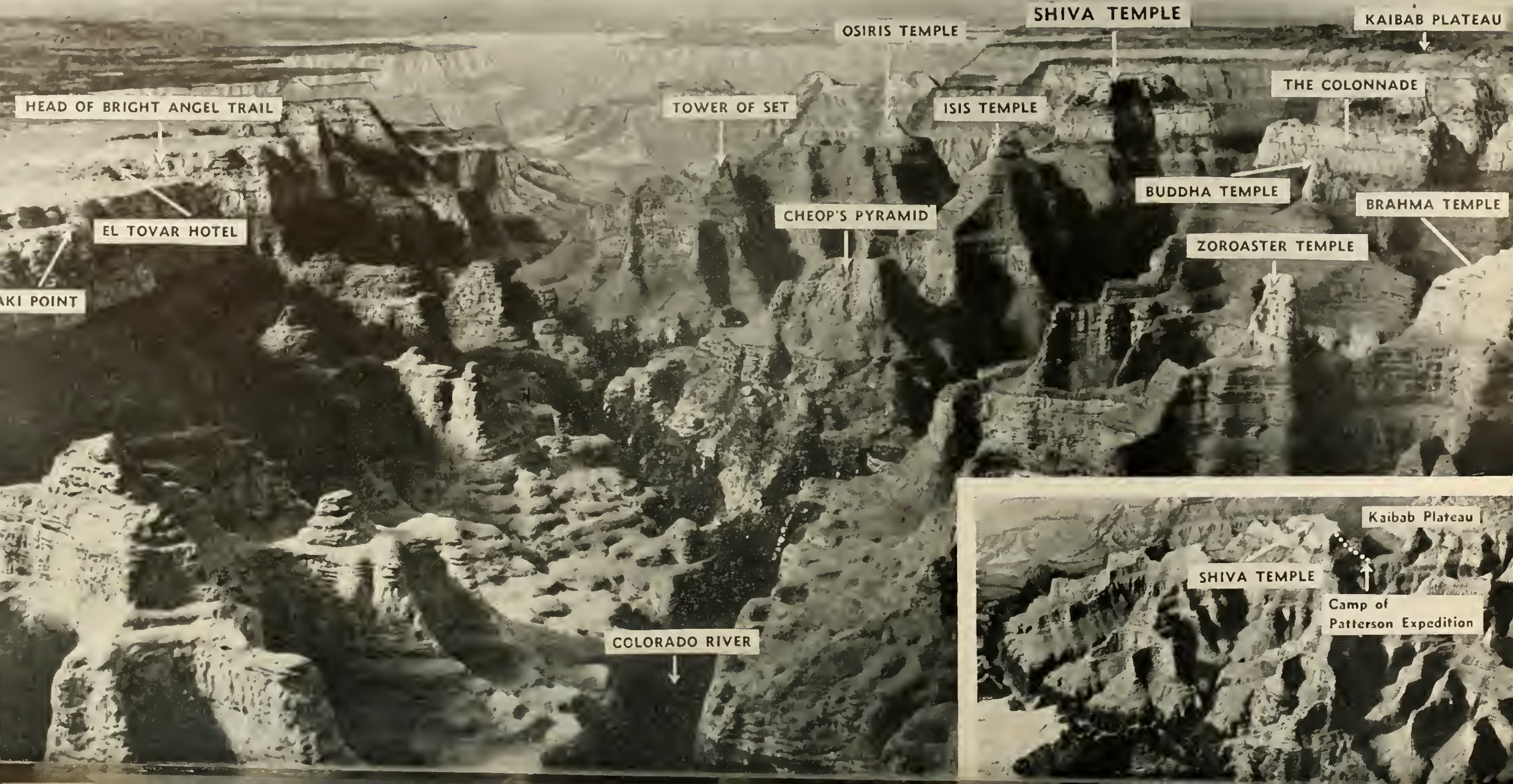
We were ever impressed by the continued politeness of the Nepalese of all ranks. Their gracious philosophy is well expressed by an incident that occurred when Queen Victoria invited the famous Maharaja Jan Bahadur to the opera. The Queen feared that because he did not understand a word of it, he might be greatly bored. But he suddenly applauded a solo as enthusiastically as the other guests in the box, and Queen Victoria asked how he could have enjoyed it, not knowing the words.

"I have always enjoyed the voice of the nightingales," the Maharaja replied, "yet I have never understood what they were saying either."

SKY ISLAND

SHIVA TEMPLE, a biological Lost World explored for the first time by the Patterson Grand Canyon Expedition of the American Museum of Natural History

A 275-acre mystery land thrusting about a mile skyward in the Grand Canyon forms the summit of Shiva Temple. After a perilous climb, Dr. H. E. Anthony and his party reached this site on September 16th. If, as first observations seem to indicate, animals do live on this sky island, they should represent types existing 35,000 years ago, isolated from evolutionary changes by Grand Canyon erosion


SHIVA TEMPLE
OSIRIS TEMPLE
KAIBAB PLATEAU
THE COLONNADE
HEAD OF BRIGHT ANGEL TRAIL
TOWER OF SET
ISIS TEMPLE
BUDDHA TEMPLE
BRAHMA TEMPLE
EL TOVAR HOTEL
CHEOP'S PYRAMID
ZOROASTER TEMPLE
AKI POINT
COLORADO RIVER
Kaibab Plateau
SHIVA TEMPLE
Camp of Patterson Expedition

WINGS WIN

Showing that neither fins, feet, wheels nor propeller-driven airplanes can compete with Nature's tiny Speed Champion, Cephenomyia

BY ROY CHAPMAN ANDREWS

Director, American Museum of Natural History

THE ACCREDITED SPEED CHAMPION OF THE WORLD: the deer bot fly, *Cephenomyia pratti* Hunter, to which a speed of 818 miles an hour has been ascribed

Courtesy, U. S. National Museum

WHO, or what, is the Speed Champion of the world? It is an insect rejoicing in the name of Cephenomyia. A rate of 400 yards per second or 818 miles an hour has been chalked up against him—*him*, because the female does not fly quite so fast for obvious reasons. That is estimated by the best scientific observations. Still, I'd feel more comfortable about Cephenomyia's reputation if it were possible to subject it to tests in a wind tunnel.

That being out of the question we must accept the word of Dr. Chas. H. T. Townsend, a scientist who has devoted many years to the study of insects and this one in particular. Doctor Townsend says in a letter:

"They are no sooner detected as a passing streak than they are entirely out of sight on a straightaway course. They pass at a speed that is next to invisible—like a flash of light almost—not over a half second—just a blurred streak in the air but never visible and giving no sense of color. The time was checked repeatedly with the shutter of a camera. The data are practically accurate and as close as ever will be possible to measure."

In an article in the *Journal of the New York*

Entomological Society (Vol. XXXV Doctor Townsend writes:

> "Regarding the speeds of Cephenomyia, the idea of a fly overtaking a bullet is a painful mental pill to swallow, as a friend has quaintly written me, yet these flies can probably do that to an old-fashioned musket ball. They could probably have kept up with the shells that the German big-bertha shot into Paris during the World War. The males are faster than the females, since they must overtake the latter for coition. Then the males habitually fly at higher altitudes than the gravid females, and thus encounter less friction which enables them to attain greater speeds. Besides the gravid females are heavily laden with ova and young, which must make them slower than the males. At 7000-foot levels in the Sierra Madre valleys of western Chihuahua I have seen the gravid females pass while on search for hosts at a velocity of well over 300 yards per second—allowing a slight perception of color and form but only a blurred glimpse. On the other hand, on 12,000-foot summits in New Mexico I have seen pass me at an incredible velocity what were quite certainly the males of Cephenomyia. I could barely distinguish that something had passed—only a brownish blur in the air of about the right size for these flies and without sense of form. As closely as I can estimate, their speed must have approximated 400 yards per second."

Around the World in 17 Hours

If it were possible to drive an airplane at the speed of Cephenomyia for 17 hours continuously we could go around the world in a daylight day. Eight hundred and eighteen miles an hour is approximately twice as fast as our fastest planes. Sound travels through the air at only 1089 feet a second.

Although Cephenomyia flies at high altitudes where air resistance is reduced, in the lowlands of New Jersey lives a considerably larger fly which can take off from a twig with such velocity that it is utterly impossible to see where it has gone.

As a matter of fact it is not surprising that insects can claim the speed championship of the world because they have been flying longest. Birds have only been on the earth for a paltry 135 million years, whereas a heritage of several hundred million years in Nature's trial-and-error flying school lies behind the insects.

The birds, however, have not done so badly. It is difficult to measure their speed accurately, but probably the swift is one of the fastest of them. When feeding it is believed by Colonel Meinertzhagen to fly at a 70-mile per hour rate but can better that to more than 100 miles per hour. Personally I believe that is much too conservative an estimate.

A swallow is said to have flown a distance of 160 miles from Roubaix to Paris in 90 minutes or at a ground speed of 106 miles per hour. A great bearded vulture was once pursued by an airplane and went into a nose dive to which the plane's speed indicator gave a velocity of 110 miles per hour. However it is hardly fair to call this flying speed. The golden eagle has been clocked at 120 miles per hour, and the duck hawk (hunting) at 165-180. It seems unlikely that this extreme speed could be maintained by the bird unassisted by diving or by a tail wind.

Colonel Meinertzhagen, a scientist who has been much interested in this subject, advertised in "The Times" for information from airplane pilots as to the height at which they had seen birds fly. The good professor did not seem to have been taken seriously as one reply indicates. It was:

"On April 1st, I was surprised to meet 40 cock ostriches at 17,000 feet. I attacked them at once and broke up the formation."

Fish and other creatures of the water have attained a wonderful beauty of movement; but the density of water presents a handicap that keeps them quite "out of the running" in the matter of sheer speed. Any land animal is greatly retarded the minute it enters the water. The greatest swimmer cannot travel a fifth as fast as the record sprinter. It would seem therefore that the fish must forever be content with a rate of locomotion far below that of the creatures that are born to the air. But the flying fish presents an exception to the phrase "as helpless as a fish out of water."

Nature's Seaplane

The striking thing is that although the flying fish presumably swims quite fast under water, it attains the high velocity necessary for the take-off after it has emerged but before it has lifted its tail quite out of the water. The propelling effect is given by a rapid side-to-side vibration of the tail, which if carefully observed is seen to leave a wave-ring disturbance on the surface of the sea. In this respect the flying fish employs a technique comparable to that of some of our fastest speed boats, which scarcely touch the water except in the region of the propeller. The wing-like fins in the opinion of most observers do not beat the air like the wings of a bird, but merely support the body of the fish in the air. In this respect and in the form of the body, the flying fish more closely resembles the airplane than does any other flying creature.

The fish "taxies" for a take-off just as a seaplane does, except that instead of a propeller it uses its tail in a sort of sculling movement. After gathering speed in this fashion for from 5 to 20 yards, the flying fish can take off in any direction, even down-

MILES PER HOUR 0 10 20 30 40 50 60 70 80 90 1

SCISSOR-TAILED FLYCATCHER (A) 10
WOODCOCK (A) 13
SWAINSON'S HAWK (A) 15
CATBIRD (A) 16
SNOW BUNTING (F - ¼ hr. - J) 16.7
SONG SPARROW (A) 17
VESPER SPARROW (A) 17
BLUEBIRD (A) 17
AMERICAN EGRET (A) 17
ARKANSAS KINGBIRD (A) 17
SLATE-COLORED JUNCO (A) 18
GOLDFINCH (A) 18
BLACK SKIMMER (A - 3 mi. - O) 18
CHIPPING SPARROW (A) 20
PURPLE MARTIN (A) 20
BLUE JAY (A) 20
FLORIDA CORMORANT (A - O) 20
MEADOWLARK (A) 20
INDIGO BUNTING (A) 20
TURKEY VULTURE (E) 21
NIGHTHAWK (A) 22
BROWN THRASHER (A) 22
RED-TAILED HAWK (A) 22
YELLOW-BILLED CUCKOO (A) 22
RUFFLED GROUSE (A) 22
KINGBIRD (A) 23
RUSTY BLACKBIRD (A) 23
RAVEN (A) 24
BLACK-BELLIED PLOVER (A - Q) 24
NORTHERN FLICKER (A) 25
SPARROW HAWK (A) 25
LAND RAIL (G) 25
TREE SWALLOW (A) 25
BLACK DUCK (A) 26
BALTIMORE ORIOLE (A) 26
WILLET (A - O) 27
GLAUCOUS-WINGED GULL (A) 28
BOAT-TAILED GRACKLE (A) 28
GREAT BLUE HERON (A) 28
RED-WINGED BLACKBIRD (A) 28
COMMON TERN (A) 29
BLACK-HEADED GULL (A) 30
BRONZED GRACKLE (A) 30
BROWN PELICAN (A) 30
BANK SWALLOW (A - H) 31
GREAT BLACK-BACKED GULL (C) 31.1
BULLOCK'S ORIOLE (A) 32
SEMIPALMATED PLOVER (A - P) 32
SEMIPALMATED SANDPIPER (A - Q) 32
RUDDY TURNSTONE (A) 33
SHARP-TAILED GROUSE (A - 1.5 mi.) 33
HUDSONIAN CURLEW (A - 7 mi. - Q) 34
GREEN HERON (I - T - A) 34
EUROPEAN CORMORANT (A - G) 35
HOUSE SPARROW (A) 35
MAGPIE (A - H) 35
RING-BILLED GULL (A) 35
LONG-BILLED CURLEW (A) 35
HERRING GULL (A) 36
ROBIN (A) 36
BELTED KINGFISHER (A) 36
CROSSBILL (C - P) 37.1

38 BREWER'S BLACKBIRD (A)
38 KNOT (A - Q)
39 HOMING PIGEON (552 mi.)
40 WESTERN MEADOWLARK (200 yds. - A)
41 MOURNING DOVE (1 mi. - A)
41 GAMBEL'S QUAIL (300 ft. - A - G)
41 SANDERLING (P - 10 m.p.h. - A)
42 SAVANNAH SPARROW (A)
42 REDHEAD (50 mi. - E)
43 LONG-BILLED DOWITCHER (A)
43 KESTREL (G)
44 RED-SHAFTED FLICKER (A - G)
45 HOMING PIGEON (K)
45 SHRIKE (A)
45 ROOK (M)
45 BRANT (B - M)
45 WOOD PIGEON (G)
46 BARN SWALLOW (A)
48 LANNER FALCON (N)
48 GANNET (B - M)
49 BOBWHITE (A - G)
50 LAPWING (B - M)
50 SNOW GOOSE (H - M - B)
51 CALIFORNIA QUAIL (G - A)
51.4 STARLING (C)
52 WESTERN SANDPIPER (A)
52 TRI-COLORED BLACKBIRD (
53 SHOVELER (A - I)
53 EUROPEAN PARTRIDGE (K
54 HORNED LARK (A)
55 BLUE ROCK PIGEON (G)
55 RUBY-THROATED HUMMI
55 WHISTLING SWAN (B - M
55 TURKEY (G - A - 1 mi.)
55 MERLIN (G)
55 KILLDEER (A)
58 VALLEY QUAIL (A)
58 CACKLING GOOSE (A -
59 CINNAMON TEAL (A -
60 MALLARD (10 mi. - B -
60 EAGLE (E)
60 CANADA GOOSE (H -
60 CROW (E)
60 PHEASANT (K - T)
60 PIGEON (L - P)
62 PEREGRINE FALCON
65 PINTAIL (H - B - M
68 EUROPEAN TEAL
68 SWIFT (G)
70 AMERICAN GO
70 EUROPEAN GO
72 CANVASBACK
89 V

CORAL KING SNAKE (L) .72
GOPHER SNAKES (L) 1.18
PATCHNOSED SNAKE (L) 1.43
SIDEWINDER (L) 2.04
RED RACER (L) 3.60
CHICKEN (RUNNING) (A) 9
PIG (A) 11
MOUNTAIN QUAIL (RUNNING) (100 ft. - I - A) 14.5
VALLEY QUAIL (RUNNING) (G - A) 14.5
GAMBEL'S QUAIL (RUNNING) (75 ft. - A) 15.5
NUMEROUS DOGS (A) 20
ROAD-RUNNER (RUNNING) (A) 20
JESSE OWENS (100 meters) (L - C) 21.7
ELEPHANT (charging) (120 yds.) 24.5
CHARLES I. GORMAN (ICE-SKATING) (L 440 yds. - C) 25.3
DEER (WHITETAILED) (K) 30

31 EMU (RUNNING) (10 mi. - A)
35.5 WHIPPET (200 yds.) (L - C)
36 GREYHOUND (¼ mi.) (L - C)
36 MONGOLIAN WOLF (L)
40 MONGOLIAN WILD ASS (G - A)
42.3 RACE HORSE (BDB WADE) (¼ mi.)
45 JACK RABBIT (1 mi.) (H - A)
49 YOUNG BUCK DEER
60 GAZELLE (GOBI DESE
60 PRONGHORN ANTELOP
70 CHEETAH (100)

CARP .9
TENCH 1.1
PIKE 1.1
BLEAK 1.3
PERCH 1.3
BREAM 1.5
J. WEISSMULLER (100 yds.) 4.01
SUBMARINE (Cruising Speed, Submerged) 4.8
BARBEL 4.9

7 SALMON
10 PIKE
10 SUBMARINE (MAXIMUM SPEED, SUBMERGED)
30 BIG SEA MACKEREL-LIKE FISHES (CRUISING)
35 FLYING FISH (JUST BEFORE TAKE-OFF)
35.9 NORMANDIE (3474 statute mi.)
36.9 WARSHIP LEXINGTON (385 statute mi.)
74.39 OUTBOAR

wind. The speed it attains at the end of the "taxi" is probably in the neighborhood of 35 miles an hour, according to the observations of Carl L. Hubbs* and others. None of our aircraft are able to take off at a speed as low as this.

To many species of animals, of course, the survival of the fittest has meant the survival of the fastest. The Hunting Leopard, or cheetah, is supposed to be the fastest animal for a short distance. It is built to get its prey in one flashing dash and can do 100 yards at a speed of 70 miles an hour. But he couldn't run a mile anywhere near so fast.

Timing land animals

In the Gobi we made the first tests of an antelope's speed with our cars. We found that the desert gazelle could reach 60 miles an hour. It could maintain that rate for a mile or two; then dropped to 50 and then 40 miles per hour. How long it could go on at that rate we did not discover. Shackelford and I chased one fine buck for ten miles but the race ended when we got a puncture and he didn't. Of course, the great speed of the initial dash is to save them from wolves.

The Gobi wolves, by the way, can only reach 36 miles an hour. The Mongolian wild ass had a maximum of 40 miles for perhaps a furlong. Not all of them could reach that speed but none were slower than 35 miles per hour.

Mr. Archibald Rutledge says that while driving down a country road a young buck deer ran in front of him. The speedometer of his car registered 49 miles but he could not gain on the animal.

The dog has from earliest times helped man to hunt animals that would be too swift for him to capture unaided. But the hunting dogs are not the fastest. The greyhound and whippet, bred for speed, can run at about 35 miles an hour.

Dr. William K. Gregory, of the American Museum of Natural History, has revealed an interesting relationship between anatomy and speed.† In the fast animals like the horse and the deer, he points out that the lower bones of the leg are longer in proportion to the upper, and these animals achieve their great speed by a rapid snap-kick stride. The action of a whip-lash or of a man wielding a golf stick illustrates this principle. Flexibility of spine enters into the case of the greyhound, for instance, for it enables him to make a much longer stride than he could accomplish otherwise. But the important thing seems to be the proportion between the length of the distal elements (the shin and foot in man) and the proximal elements (the thigh).

If the same applied to human beings we might expect a runner with long shins and short thighs to outstrip a competitor whose shins were not so long in proportion. The proportion of the leg bones in man does not vary much, but where records depend upon a split second it is conceivable that even a small difference might make or break a champion. Such investigations as have been made, however, limited by rather scanty data, seem to reveal no such rule applying to man.

Bicycling at 75 miles an hour

No man has ever run a hundred yards in less than a little over 9 seconds, which is at an average speed of about 22 miles an hour, and this with spiked shoes on a special track. Spiked shoes enable the sprinter to run appreciably faster than he can barefooted; and by fixing steel blades to his feet, the ice skater can travel faster than the fleetest runner, but surprisingly only three or four miles an hour faster. The greatest velocity at which a man has ever traveled under his own power on a level track is, to my knowledge, on a bicycle. In 1928, in Paris, Vanderstuyft attained the almost incredible speed of 75 miles an hour; but this was possible only directly in the wake of a speeding motorcycle which considerably lessened the air resistance. With all the advantages of mechanical ability man has only within the present generation approached the speed of some of the lower animals. It is not improbable that an exhaustive study of the mechanism of birds and insects may point the way toward much higher speeds in planes by discovering all the mechanical principles involved.

Perhaps we had better not commit ourselves as to whether it is the superior streamline, or extraordinary wing strength, or merely the knack of knowing how to use their wings that gives some insects their speed. Science has yet to solve this riddle. So far the insects may be ahead, but man has only recently spread his wings—and the sky is the limit.

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*"Nature's Own Seaplanes," by Carl L. Hubbs, in *Annual Report of the Smithsonian Institution, 1933.*

†"Notes on the Principles of Quadrupedal Locomotion and of the Mechanism of the Limbs in Hoofed Animals," by Wm. K. Gregory.

THE INTERIOR OF NEW GUINEA, one of the few large areas as yet unexplored, was the object of the Archbold 1936 Expedition, bent on collecting specimens and data for the American Museum of Natural History. The unusual difficulties of transporting food which have defeated many exploratory efforts, were overcome by a highly organized system of communications between aerial and ground parties

(Above) ONE OF MANY unexplored spots visited by the Archbold Expedition plane: Lake Marguerita, viewed through the clouds which continually hindered the Expedition's work

ARCHBOLD 1936 EXPEDITION PLANE at coast headquarters, Daru. From here five flights over unknown rivers, lakes, mountains and villages prepared the way for the overland parties

PHOTOGRAPHS BY THE AUTHORS AND G. H. H. TATE, L. J. BRASS, M. J. HEALY, AND L. A. WILLIS

WITH PLANE AND RADIO IN STONE AGE NEW GUINEA—*Provisions dropped by parachute carried the Archbold 1936 Expedition far into the jungle, but mishap forced them to adopt prehistoric means of travel on crude rafts*

By RICHARD ARCHBOLD
Research Associate, Department of Mammals, American Museum of Natural History
and
A. L. RAND
Assistant Leader of the Archbold Expeditions

THE country of the upper Fly River lives in the Stone Age. Here the native tracks are faint trails through the forest and the canoes crude dugouts hollowed from logs with fire and stone axes. Naked men till their gardens, tend their pigs, thatch their huts and wage their wars hardly knowing that there is a world in which steamboats and motor cars exist, or even spades, steel knives, cooking pots, clothing and matches.

Primitive versus modern

It was amongst such primitive conditions as these that our inland party camped near the junction of the Black and Palmer rivers, 600 miles up the Fly River in June, 1936. Here they looked out from their radio table and saw the plane floating in the river and at the same time, saw the natives collecting firewood with stone axes. Here on the Upper Fly the natives showed them how to make fire with a piece of rattan drawn back and forth around the end of a split stick. When shown how the white men make fire with matches and given a box of them, the natives struck the wrong end of the match and tried to light the same one again and again. Their food is roasted in the fire, their paddles are mere bits of bark stuck in the end of a cleft stick, and their clothes are practically non-existent.

It had taken two weeks for the inland party to reach their first camp by boat, but after that supplies were brought in by plane from Daru in about two hours. Meanwhile radio linked the two parts of the expedition. How this would have amazed the early explorers on this river—D'Albertis, the only natural history collector in this area and the first to ascend the river, who went up it about 500 miles in a woodburning steamboat in 1873; and MacGregor, who went 600 miles up the stream in 1890, pulling the last part in a whale boat manned by South Sea Islanders.

The years that have passed since the time of these pioneers have brought little change to the country although much advance has been made in methods of transport. Until 1927 no one had gone farther inland than had MacGregor in 1890 and the source of the Fly was still unknown. In 1927-29 the Papuan government Northwest Patrol found a way across the limestone barriers of the mountain foothills and on its way across New Guinea, mapped the headwaters of the Palmer River, tributary of the Fly, and the steep Dap Range beyond.

And now we were to explore this area for mammals, birds and plants. With Mr. Archbold, who directed operations from the coast, was Russell Rogers, pilot, who helped fly the plane, and Ewing Julstedt, radio operator. A. L. Rand, assistant leader and ornithologist, G. H. H. Tate, mammalogist, and L. J. Brass, botanist, carried on the scientific work inland, while L. A. Willis arranged the transport inland. M. J. Healy, government police officer and six native police boys provided protection for the inland party.

Unknown land

When we first reached Daru in March, 1936, we made several reconnaissance flights over South New Guinea but failed to find a better way into the mountains where we hoped to collect than the track of the 1927-29 patrol. From the air on these same flights we traced the course of unknown rivers, discovered new lakes, circled unclimbed mountains, looked down into thousand-foot gorges, saw hundreds of villages never visited by white men and tried to write or sketch it all on a time and compass traverse, to mark it later on a map. Mr. Woodward, the resident magistrate at Daru who accompanied us on one of these flights said that in the few hours of flying he saw more of the district under his control than in the preceding ten years in which he had been traveling over it by boat and on foot.

An immediate purpose of the reconnaissance flights was to pick out inland depots where the collecting party would camp and where supplies would be delivered by the plane. This we did, choosing one near Palmer Junction; another at the 610 mile mark on the Palmer River near where MacGregor had been turned back by the limestone barrier so many years ago; another still farther inland, in an abandoned native garden on the end of Mt. Blutcher, the bluff end of the Muller range, which guards the upper valley of the Palmer River; and a fourth in the mountains where it was planned to build up an emergency store, east of Mt. Mabion and near the slopes of the Dap Range. There we hoped to collect at 2000-foot intervals from 3000 feet to 10,000 feet.

The inland party then went up the river by boat and made camp at Palmer Junction where the plane could land on the river. This camp was on a forested ridge where crested pigeons as big as turkeys visited the clearing. Each evening flocks of the rare metallic starlings darted over, and long thin lines of screaming lories passed high overhead. Each morning mist wreathed the tree tops, and here friendly, shy natives appeared out of the forest.

Beads for valuable specimens

Though shy, they were eager to trade. Small white beads they wanted especially. After the first few days we would no longer buy their bows and arrows or their scanty ornaments, but made them understand we would pay them good white beads for birds and mammals. The natives then settled down on the next ridge, built palm-thatched shelters, and devoted all their time to hunting for us. They brought us scores of specimens each day. It was nearly as good as having all the birds of the forest parade before us and being able to choose the rare and interesting specimens for our collection.

While the scientific party was collecting at this camp, an advance party consisting of Willis and Healy with most of the carriers we had brought from the coast, set off inland for the proposed camp site near Mt. Mabion that we had chosen on one of the first reconnaissance flights. They had to find a way through the trackless forest and cut a trail over which the scientific party would ultimately travel into the mountains. While this advance party was finding their way the airplane, from the base camp at Daru, was to fly in and drop supplies to them by parachute.

Because the plane could be used to bring in these additional supplies, the biggest bugbear of former travel in New Guinea was eliminated, that of relaying food by native carriers, for in New Guinea you cannot depend on local food. The local natives may be able to spare something if they have had a good harvest of sweet potatoes, but with an abundance of food on hand they are likely to have invited in all of the neighboring tribes for a feast and a dance and to have eaten everything available. Until the next harvest they themselves may be short of food, much less have anything to spare for the traveler.

In view of this a traveler into the country has to carry everything. A porter carries 40 pounds of food and if he goes inland 26 days he has eaten it all and arrives at his destination with nothing. If only half of the porters carry food and the rest equipment, the party can go only 13 days before all of the food is gone, leaving nothing for the return trip to the coast. Five or six days, therefore, is the limit which can be worked without using successive relays of boys, the inland relays being proportionately smaller as the food stores are reduced: a costly and unsatisfactory system at its best and the biggest factor in keeping New Guinea a primitive, unknown land. With new methods of transport: the airplane, parachute and radio, all the fastnesses of New Guinea will soon be explored by white men looking for gold as well as for birds and mammals.

Parachute delivery

Having experienced these food relay difficulties in 1933 when we collected on Mt. Albert Edward in southeast New Guinea, we worked out a system for the present trip by which food might be brought in from the coast by the airplane and dropped to the inland party by parachute. Breakables such as tinned meat, tinned sugar and flour and kerosene were dropped by parachutes 24 feet in diameter. These, when loaded with 100 pounds of supplies each, land them with the shock they would receive if they fell from a height of eight feet. Most things can be packed to stand this jar. For dropping rice, the staple food of the boys, we did not need a parachute. We packed it tightly in 40-pound sacks (the proper weight for a boy to carry) which were loosely enclosed in heavy outer sacks and these were simply thrown from the plane. When they hit the ground the inner sack exploded but the contents were retained in the outer sack.

A Modern Exploratory Campaign Combining Travel by Plane, Boat, Raft and on Foot, and Using Parachutes for Food Delivery

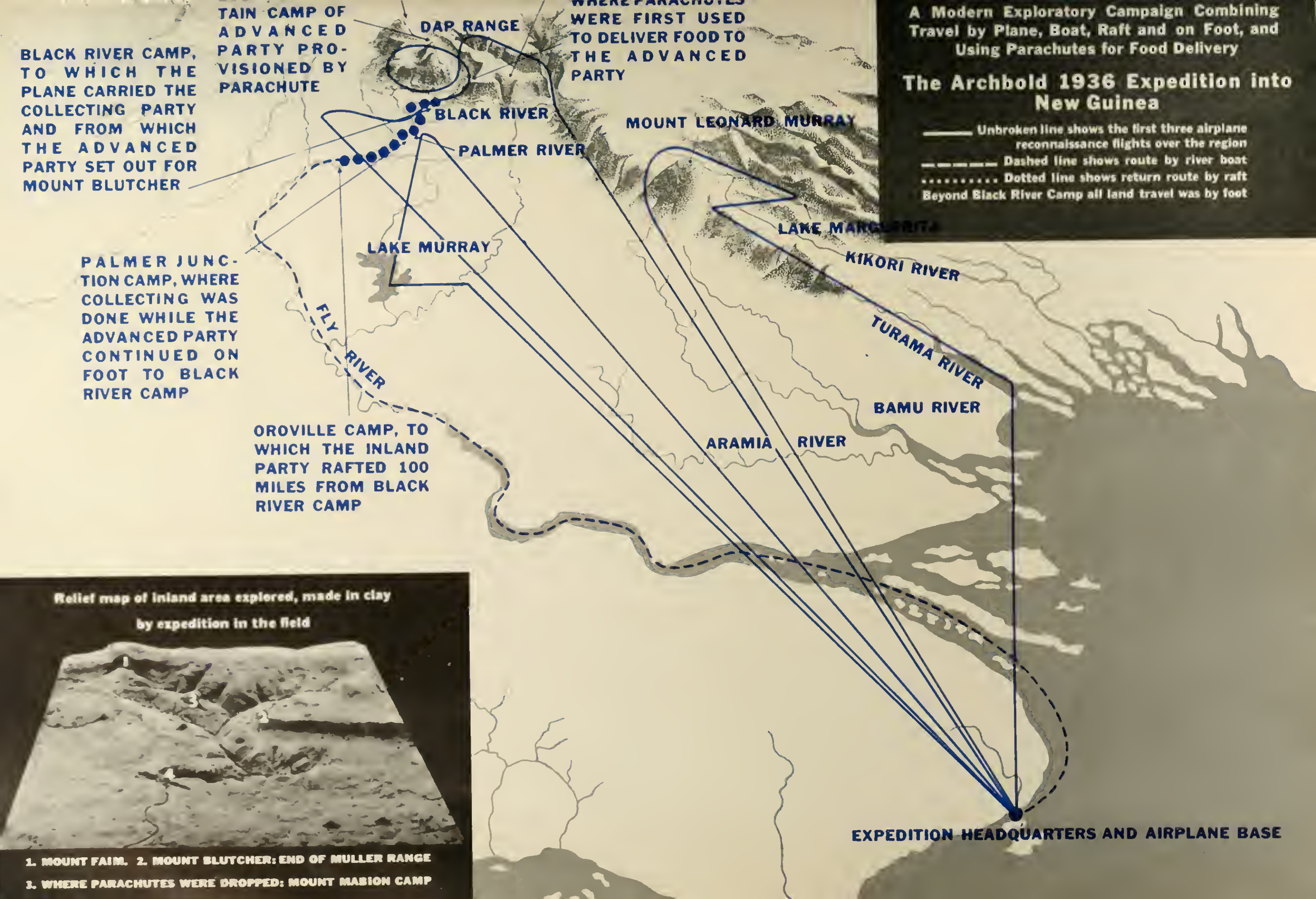
The Archbold 1936 Expedition into New Guinea

——— Unbroken line shows the first three airplane reconnaissance flights over the region

— — — Dashed line shows route by river boat

. . . . Dotted line shows return route by raft

Beyond Black River Camp all land travel was by foot


TAIN CAMP OF ADVANCED PARTY PROVISIONED BY PARACHUTE
DAP RANGE
WHERE PARACHUTES WERE FIRST USED TO DELIVER FOOD TO THE ADVANCED PARTY
BLACK RIVER CAMP, TO WHICH THE PLANE CARRIED THE COLLECTING PARTY AND FROM WHICH THE ADVANCED PARTY SET OUT FOR MOUNT BLUTCHER
BLACK RIVER
PALMER RIVER
MOUNT LEONARD MURRAY
LAKE MARGUERITA
KIKORI RIVER
TURAMA RIVER
BAMU RIVER
ARAMIA RIVER
LAKE MURRAY
PALMER JUNCTION CAMP, WHERE COLLECTING WAS DONE WHILE THE ADVANCED PARTY CONTINUED ON FOOT TO BLACK RIVER CAMP
FLY RIVER
OROVILLE CAMP, TO WHICH THE INLAND PARTY RAFTED 100 MILES FROM BLACK RIVER CAMP
EXPEDITION HEADQUARTERS AND AIRPLANE BASE
1
2
3
4

Relief map of inland area explored, made in clay by expedition in the field

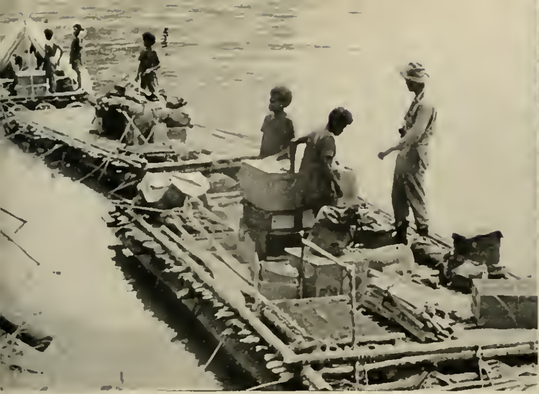
1. MOUNT FAIM. 2. MOUNT BLUTCHER: END OF MULLER RANGE

3. WHERE PARACHUTES WERE DROPPED: MOUNT MABION CAMP

(Above) Stranded deep in the interior by the sinking of the plane, the inland party gathered logs for the building of crude rafts to carry them coastward

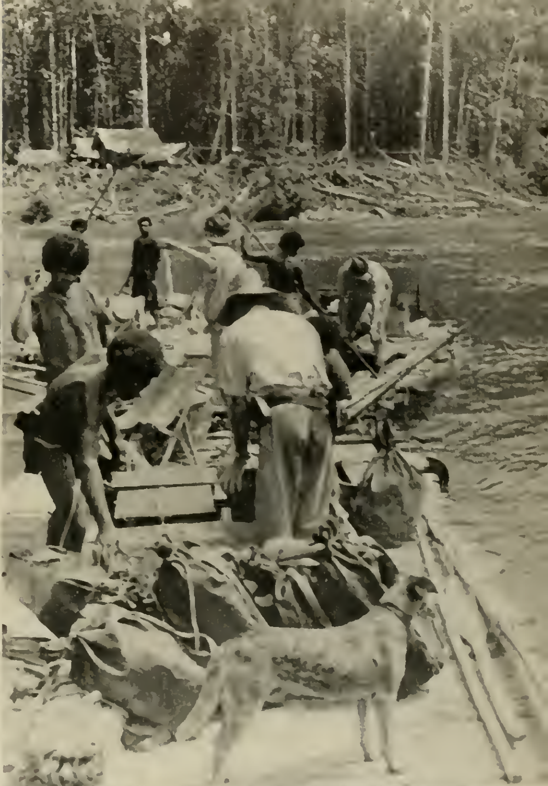
(Above) A primitive deck of saplings was lashed to the 20-foot logs, which had to be selected with care for in New Guinea only certain timbers float

(Below) An extinct volcano rising to about 9000 feet: cloud-girt Mount Leonard Murray, viewed on one of the reconnaissance flights. Many mountain ranges enhance the beauty and interest of New Guinea, but increase the difficulties of exploration. In country mantled by dense vegetation rivers and lakes offer welcome landing places

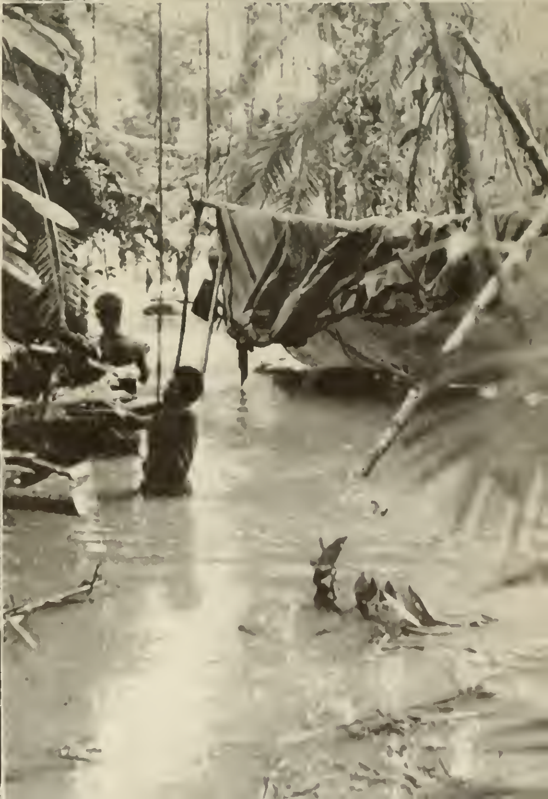


(Above) THE EXPLORERS equipped each raft with an earth-filled fireplace, firewood, cooking gear, tent and food for three weeks. Oars were split from logs

(Right) THE FLOATING VILLAGE comprised five white men, 60 natives and two dogs. Collections were endangered when flood brought a nine-knot current and a splintering collision with floating trees



(Right) REFUGE from the swift flood was sought in the inundated forest, where repairs were made. Tents and supplies are seen hanging on the poles



(Below) A RAFT BEING REBUILT. Despite difficulties the expedition reached Oroville, whence river boat took them to the coast. Abundant specimens and a new knowledge of inner New Guinea and its transportation problems handsomely rewarded the expedition and encourage the explorers to undertake an even more ambitious program early next year. Their goal will be the highest altitudes of the little known Snow Mountains

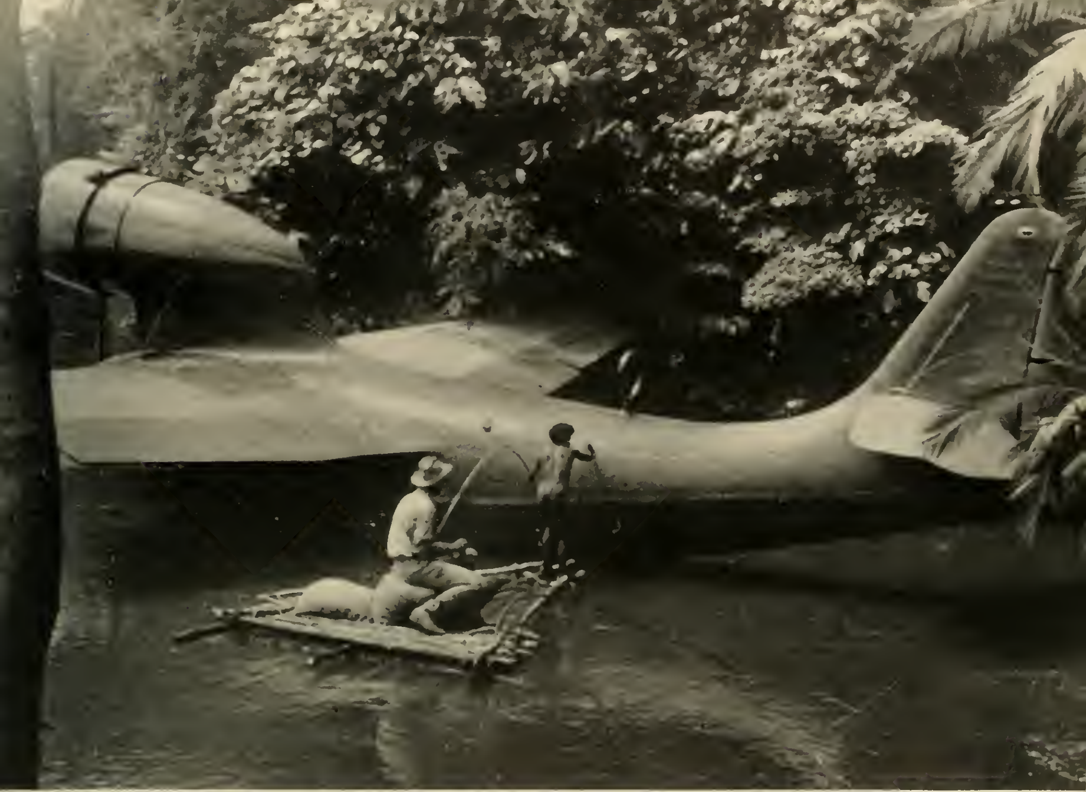
(Left) Unloading supplies at the first inland camp 528 miles up the Fly River at Palmer Junction. A two weeks' boat trip was required to reach this camp; the plane brought supplies in two hours

Savages who were not savage: Naked porters recruited from local villages, who though extremely primitive and unused to white men, proved helpful and friendly. They traded valuable scientific specimens for white beads

(Left) Native-built thatched huts supplemented tents at the Black River Camp, adding room and comfort. Here the party had their first view from the river of the mountains in which they planned to collect

(Lower left) Bound for Mount Mabion: porters carrying equipment as Willis and Healy quit Palmer Junction Camp to establish a camp near Mount Mabion, previously selected from the air

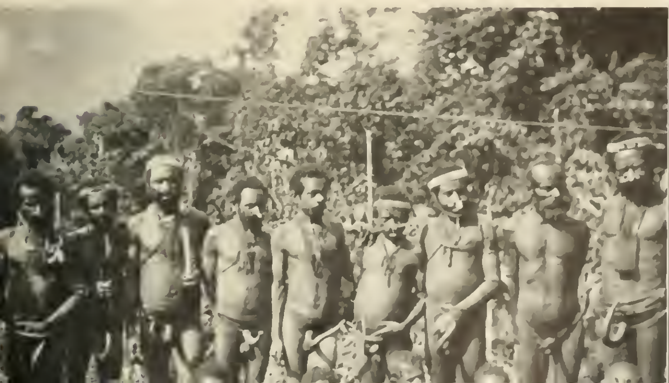
(Below) "Manna" by parachute: 100 pounds of food descending at Mt. Mabion to the advanced party, who were able to carry food for only a short time. Each load landed with the force of an 8-foot fall



(Above) A MODERN PLANE rides the ancient jungle waters: A step in the transfer of Palmer Junction Camp to Black River Junction. Previous explorers in New Guinea were seriously handicapped in relaying food supplies on foot. By using airplane, radio and parachutes, the Archbold Expedition was able to enjoy even a few luxuries. But when the plane was sunk by a sudden storm, a complete change of plans and prompt action were necessary

(Below) ADORNMENT, NOT MODESTY, is the purpose of clothing in New Guinea. Job's tears, boars' tusks, rattan bands, slender gourds and small string bags form their ornaments

(Below) "GRASS SKIRTS" were in vogue among the Unkia women near Mount Mabion. The little mountain people in this region proved friendly and assisted the party in reaching its farthest inland goal



Previous explorers, dependent solely on the old type of transport, had to get along with the barest necessities, whereas by using airplane and radio to supplement the carriers we were able to have not only a sufficiency of necessities but a few luxuries like tinned fruits and vegetables.

On June 1 we left Daru to re-provision Willis and Healy at the 610-mile mark on the Palmer River. But they were not at the pre-arranged rendezvous. Flying along the river we finally found them two miles below the junction of the Black and the Palmer rivers, fifteen miles short of their objective. We were able to land. The whole party was in good shape but the travel had been much more difficult than they had anticipated, the country rough and the ground muddy. They had had to cut through tangles of lawyer cane and had crossed streams in dugout canoes or waded through them with water reaching the waists of the carriers. Ten days before, they had left the river base camp, 25 miles away as the crow flies. And the plane which had left Daru that morning, 300 miles away, had reached them before noon! Re-provisioned they set out for the Mt. Blutcher rendezvous another 25 miles away, where the plane was to supply them with food again in ten days time.

In the meantime we had found it advisable to move up the river camp base from below the Palmer Junction to the new landing place on the river near the Black River Junction. The straight stretch of river here was much shorter and narrower, but safe enough if the plane was lightly loaded. It took us two days to fly the five tons of equipment and supplies, including the reserve emergency rations, to the new camp. To have moved it overland and with carriers would have been heart-breaking.

From this new camp, the lowest point on the river from which the mountains can be seen, we had a view of the mist-draped ranges in which we planned to collect. Through our glasses we could see the individual bushy topped trees on their summits, and yet we found it was four days on foot to the base of the nearest range.

Trails flooded

As at the Palmer Junction camp the Black River country was all forested, but more of it was low and wet. The much traveled track which led out of camp soon became deep with mud. And when the river flooded as it did twice during our stay, several of the tracks through the forest near camp were inundated.

At this camp we added more of the rare birds to our collection; the lovely black and yellow cuckoo shrike that was difficult to collect because it kept moving about in the tops of the tallest trees; the twelve-wired bird of paradise, little green parrots with orange ruffs on their cheeks (we only saw them in one tree where they were going in and out of cavities far up in the branches), the shovel-billed kingfisher that digs in the ground for the worms on which it feeds, and the golden bower bird with black wings and tail, golden yellow body, and elongated, orange feathers on the neck which give the effect of a foam-like cape.

We kept the little collapsible boat which belonged to the plane with us at this camp, and when tired of the eternal gloom and dripping moisture of the forest we found it pleasant to go out in the sunshine on the river where the sky was not screened by greenery overhead.

Abundant bird life

Some writers on New Guinea have mentioned how void of life the rivers seemed to them. This may be true of the larger rivers near their mouths but here on the smaller headwaters there was always something to see or hear. Sometimes it was the red bird of paradise flying across. Always white cockatoos were flying overhead screaming and scolding. Grey crows flushed from the gravel bars with their exasperating *Ka-Ka-Ka;* they always seem frantic with excitement, though there never seemed cause for it. Forest pigeons dashed across the river and hurtled into the forest again. Occasionally we found cassowary tracks on the banks but were never fortunate enough to see one from the river. Solitary white herons made a dignified silhouette against the greenery; there were always bee-eaters and sacred kingfishers about and when the weather was dull swifts fed low over the water.

The D'Albertis creeper came into bloom during our stay at this camp. The vines grow only along the river, where they nearly smother the trees and the beauty of the clusters of large, scarlet pea-like flowers made river travel doubly pleasant. The best display we saw was on a little waterway just above camp. The vivid color of the flowers burned out from the dark foliage and here and there, from nearly naked vines draped from tree to tree, clusters of blooms dangled like lighted paper lanterns.

Though our collections were growing apace we were impatiently looking forward to moving into the mountains to collect in that even more remote area, and eagerly awaited news of the trail-cutting party.

The plane next contacted and re-provisioned them at Mt. Blutcher on their way to Mt. Mabion, ten days after we had met them at Black River, and this the first actual parachute delivery, was a complete success.

The old native garden, chosen weeks before during the preliminary airplane flights as the place to drop the supplies proved unmistakable both to the land and the air party. As we flew around the field the pitched tents and the boys waiting around the edge of the clearing were plainly seen. We landed two parachute loads of stores for Healy and Willis and twelve 40-pound sacks of rice for the boys. About ten pounds of rice which spilled from a burst bag was our only loss.

The advance party was now only a short distance across the Palmer valley from the proposed mountain depot east of Mt. Mabion. Here the little mountain people appeared and proved very friendly folk, anxious to help the party. There was no longer any difficulty about the trail, the Unkia natives even pointing out to the white men where to put each foot, often hindering with their helpfulness.

About the base of Mt. Mabion the country was quite flat and fairly suitable for dropping supplies by parachute. Evidently much of it had been old native garden land, long since abandoned and now grown up to second growth. Here Willis and Healy cleared a landing place, removing logs and rocks, so that the airplane party could see plainly where to drop the supplies and the loads of provisions could be safely landed. Everything was ready on time as we found later, but when we flew in the whole mountain range was hidden in clouds. On a second flight two days later we found the valleys again concealed by low-lying clouds making delivery impossible.

It appeared hopeless to continue blindly flying from Daru to the mountain camp, merely hoping that weather conditions would permit landing supplies there. The portable radio was still with the scientific party at Black River and we decided to send it to Mt. Mabion so that at Daru we could get immediate reports on cloud conditions and know when to attempt delivery flights.

It was necessary for Willis to send out carriers from Mt. Mabion for the radio, so when we were able finally to make the next food delivery, we dropped a letter asking him to send out the required number of carriers.

Accident to plane

Tate had to discontinue collecting mammals at the Black River camp and go in as radio operator. It was an anxious morning for everyone when the radio was set up in the mountain camp. But it had withstood the jolts of being carried for seven days over the rough trail inland. Tate contacted Daru. And the first message he received was that the airplane had been sunk by a sudden storm in Port Moresby harbor. A complete change of plans and prompt action was necessary.

An immediate retreat of the mountain party was started. Plans for collecting in the mountains had to be abandoned and all our efforts directed toward taking all the inland party down the river to meet the rescue boat that Archbold was bringing up.

There was an ample store of food at the Black River camp to feed the whole party until they built rafts and floated down to meet the up-coming rescue boat. But if Tate, Willis and Healy at Mt. Mabion were to reach the Black River camp without abandoning their equipment and making a dash for it, they had to have more food.

To supply them, we took advantage of the commercial airways in New Guinea. Rogers flew to Lae, in northeast New Guinea and center of the air service in the country, and chartered a ship. In this he flew 400 miles over the central ranges of New Guinea to the mountain camp at Mabion and dropped food supplies to the advance party. This enabled them to retreat to the river base with all their equipment.

Retreat by rafts

As soon as Rand and Brass at the river base camp received the news of the loss of the plane, they started to build rafts. The whole inland party was now faced with the necessity of using a transport that was indeed appropriate to the Stone Age country in which they were camped. The river below the camp was not navigable for a boat of any size and the party and their specimens and several tons of gear had to be rafted down the river to meet the boat that was being brought from the coast.

The boys at the base camp were sent out to cut floatable logs two feet thick at the base and 20 feet long. These were floated to a shallow bank just above camp and groups of four logs were tied together with cross pieces to form the body of the raft. A platform of small sticks was put on top and the whole lashed together with lawyer cane, a common rattan used for almost all tying in New Guinea. Oars were split from logs and the twelve rafts were finally completed on August 5. Five of them were to have a white man and five boys aboard, the others, five or six boys. Each was equipped as a unit with a fireplace, firewood, tent, cooking gear and food for three weeks in case any raft became separated from the others. Tate had his rats on his raft, Brass his plants on his and Rand, his birds on his. Some of the rafts had more than 1500 pounds on board including live cargo. They were to keep in line, Healy's raft leading, with a boy's and a white man's raft alternating, and Rand bringing up the rear. The collapsible boat, originally intended for the plane, was to go back and forth, keeping the whole line in communication.

With sixty boys, five white men and several tons of cargo, the inland party started rafting what was to them an unknown river. They had seen it by boat from the mouth of the Fly to Palmer Junction, but between that place and the river base camp they had seen it only from the air, knew that it flowed through hilly country, that the 1927 northwestern patrol had rafted it, and, very pertinent, that there was a bad rapid several miles below camp.

The first few miles of the trip were peaceful enough but soon the flotilla came to the rapid, on a bend, full of dead timber with a wide gravel bar in the middle. Rand's raft with his bird skins on board was swept too near the outside of the bend. It came crashing down through the lodged timber to be finally caught in the boughs of a dead tree, where it was held fast by the cases of bird skins lashed on board. The rush of the water threatened to capsize the raft or to tear loose the cases of bird skins, sending the collection into the river, but the lashings held and the raft stayed right-side-up until the boys were able to cut and push it free. A few boys sent ashore soon had enough lawyer cane to strengthen the strained lashings. Although the raft was more diamond-shaped than square, it was still as seaworthy as such a craft can be.

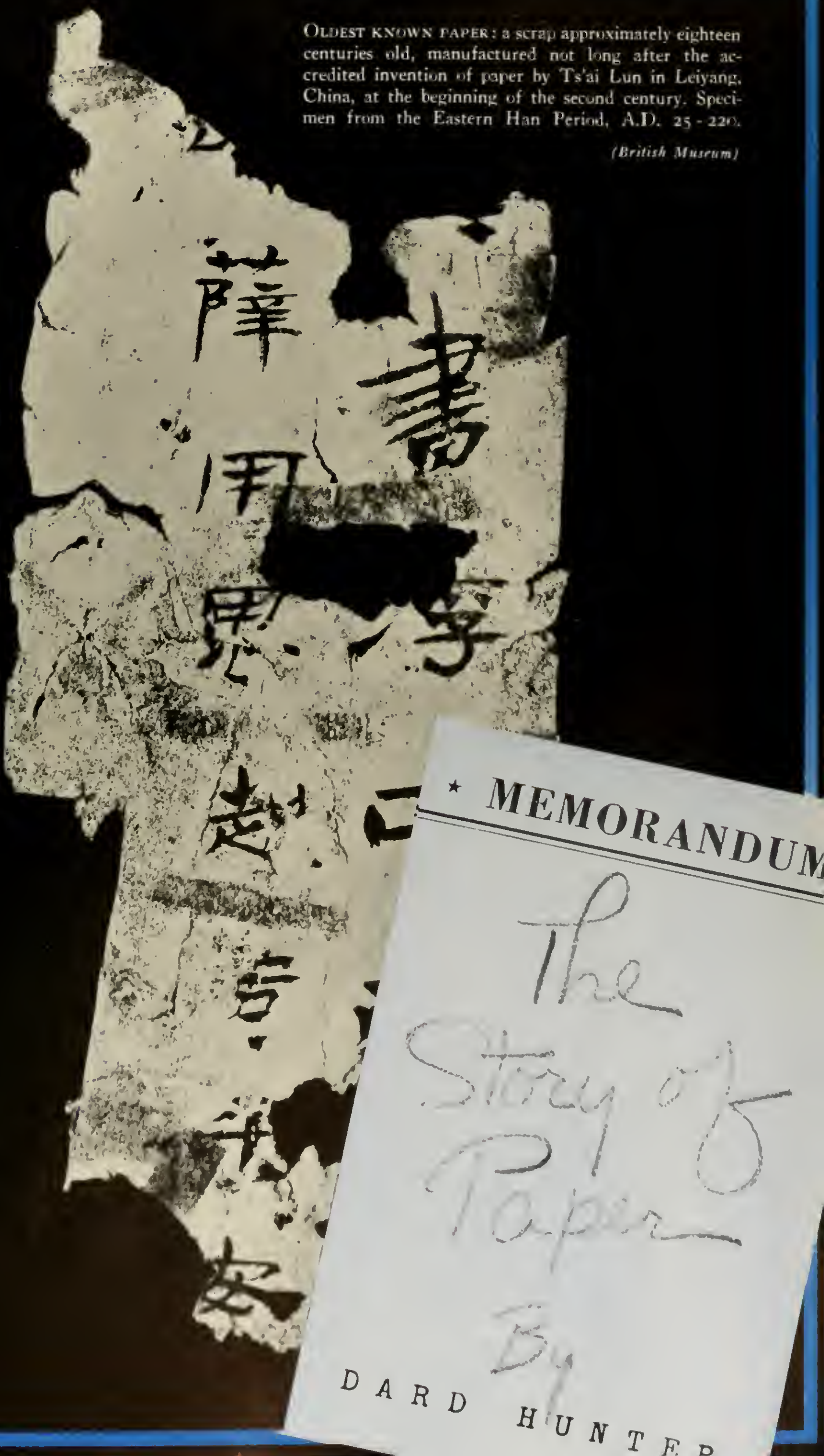
From here a four- or five-knot current swept them swiftly down through the hilly country. Blinding drenching rain overtook them before they finally moored their fleet of rafts in the shallow water under a ten-foot bank that night. The smoke rising from the little shelters improvised from flies and tents on each raft gave a queer impression of a floating village of some strange river dwellers. Everyone slept "all standing" on his own raft that night in case of flood, and it was their misfortune to have one. At dawn the river had more than filled its channel and water was flowing away smoothly above the bank through the forest. The turbulent river itself had a nine-knot current. Travel was impossible as a raft in that flood would have been dashed to pieces. As the water rose the party was safe, for they were able to float the rafts back into the forest out of the way of the current.

About noon the water began to fall and big timber, whole trees which had fallen into the stream, began to come down the river. They could be seen crashing into a bank above the rafts and then rebounding into the current and the only hope was that they would miss the rafts. Finally two big trees interlocked by their crowns came into view and disappeared from sight again as they swept into the bank above. Suddenly there was a crashing and quivering of splintering timber and the whimpering of a dog. One of the foremost rafts went shooting into the forest, snapping off saplings as it went, while the first raft snapped nine mooring lines, tore loose, hit the corner of the next raft, and with logs askew and tent partly down, started off in the current. Aboard the raft was Willis with three boys and his dog. There was nothing for the rest of the party to do but send the dinghy and a rope after him in the hope that he could get a line ashore. A few miles down, the current swung him into the bank and he was able to moor the raft in a sheltered cove. Here we found him next morning, his raft fortunately having been little damaged.

The next morning the line of rafts put off in the half flood. All that day whirlpools had to be avoided. That night the party tied up by the old Palmer Junction river base. Before them stretched the broad smooth Fly River, and rafting thereafter in the two- or three-mile current became dull and monotonous. After two days which passed with little event they reached Oroville, 30 miles above D'Albertis junction. The radio told them that the relief ship would soon be there. Four nights later they saw her lights downstream and an hour later she was riding at anchor below the bank.

The party had gone inland using the most advanced means of transport, plane and radio, supplemented by boat and the most primitive method of all, walking. Because of the unpredictable accident to the plane they had been reduced to entire dependence on rafting which is surely one of the earliest methods of transportation, for a floating log must have been used before a dugout canoe was thought of. And now with the *Ronald S.* at hand, the party was to rely again on a safe middle age invention—that of an auxiliary ketch—for their work of collecting on the middle Fly.

Though we had failed to reach the mountains our large collections from the Upper Fly were extremely valuable and our new methods of transport had proved so feasible that we plan to use the same system in collecting at the highest altitudes in the little known Snow Mountains of Dutch New Guinea early next year.



OLDEST KNOWN PAPER: a scrap approximately eighteen centuries old, manufactured not long after the accredited invention of paper by Ts'ai Lun in Leiyang, China, at the beginning of the second century. Specimen from the Eastern Han Period, A.D. 25 - 220.

(British Museum)

★ MEMORANDUM

The Story of Paper

By

DARD HUNTER

THE STORY OF PAPER—*Without this homely substance the accumulated knowledge of the ages could not have been recorded; its invention gave man his passport from savagery to civilization*

By DARD HUNTER

"PAPER! Paper!" cries the newsboy in every town and city of the land, but little does the young news vendor, or even the adult purchaser of his wares, realize the hundreds of years of accomplishment that lie behind the making of the ephemeral paper upon which the news of the world is daily imprinted.

This apathy toward the history and technique of papermaking is not confined to the man-in-the-street and his work-a-day newspaper, but it applies as well to the average collector of de luxe editions, fine prints and etchings. Even the most profound bibliophile with his subtle discrimination regarding the finesse of typography, color printing, margins and the "points" of rare first editions gives but little thought to the paper used in book printing.

It is perhaps only natural that most Occidental readers, both untutored and scholarly, regard paper as simply a background for handwriting and typography—very much as a painter of portraits and landscapes regards his canvas—a convenient and unobstrusive substance to which pigment may be applied without difficulty.

Wood and cloth

Long before the invention of paper, the Chinese scribes wrote with the stylus upon strips of wood, but this material was difficult to write upon and difficult to store, for the wood tied into bundles for the orderly preservation of records was heavy and cumbersome.

After many centuries of use the strips of wood were succeeded as a writing substance by woven material, especially after the invention of the hair writing brush. Cloth adapted itself readily as a writing material and the Chinese made books and scrolls of silk cloth which served well in the absence of actual paper. But woven cloth was expensive, and in ancient times as at present there was a desire to produce necessary materials in a speedy and inexpensive manner. There was waste when the silk manuscripts and documents were cut and trimmed, and it was these discarded strips of silk that no doubt suggested to the adroit and practical Chinese mind the possibilities of making paper. And in arriving at the idea of macerating the waste silk fibres and "felting" them into sheets of paper, it is probably that the early Chinese craftsmen were aided by their knowledge of felt-making, a craft that antedated even that of weaving. The usefulness of cloth waste for the purpose is shown by the fact that it remains today one of the materials best suited for making of fine paper.

The first paper

It is interesting to try to picture those first days of papermaking in the town of Leiyang, Hunan province, at the beginning of the second century, and to speculate as to the procedure followed by those ancient Chinese artisans.

After the cloth scraps had been wetted, beaten and frayed into individual particles, or fibres, the thick pulp was probably thrown into a tub filled with water. When the eunuch Ts'ai Lun, the man credited with the invention of papermaking, saw the minute fibres floating on the crest of the liquid, as wind-blown seeds from the milkweed and dandelion float on the surface of a pond or stream, it no doubt suggested to him the possibility of picking up the matted and tangled film from the water's surface and transfering the leaf or sheet intact to dry in the sun. The difficult task was to devise an implement capable of picking up the matted fibres in thin flat formation from the surface of the water which would yet allow the water to escape, leaving the interwoven fibres in an even, homogeneous sheet of paper. This need brought forth the invention of the papermaking mould, the implement that has remained the principal tool in papermaking by hand throughout the centuries and upon the principle of which the modern paper-machine is founded.

Inasmuch as no paper is in existence from the first few years of its inception, it is only possible to surmise the construction of the original moulds. It is likely that the first mould, as invented and used by Ts'ai Lun and his assistants, was simply a square of coarsely woven cloth held in a four-sided bamboo frame. This mould was dipped into the water upon which the macerated fibres floated and brought up horizontally under them, lifting the fibres as in a sieve and allowing the water to drain through the meshes of the cloth. The mould, with the thin deposit of felted fibres adhering to its surface, was then placed in the sun for drying. After the moisture had completely evaporated the sheet of paper was stripped easily from the mould. The warp and woof of the mould cloth left their impressions in the paper, just as watermarks are made today. This was the original "wove" mould, the prototype of the modern papermaking machine.

An important improvement

With a mould of this style it was necessary to allow the moist sheet of paper to dry upon the mould, and if much paper was to be made many moulds would have been required. To alleviate the slowing down of the operation the rigid transfer mould, from which a sheet of paper could be taken while moist, was originated. This type of mould was a most important step in the progress of making paper, as it enabled a worker to make sheet after sheet without interruption from the same mould. These moulds were made of thin strips of rounded bamboo laid parallel and laced together at intervals with hair. The impressions of these bamboo strips and the hair lacings may be detected in the earliest known papers. These indentations constitute the original "laid" watermarks and many modern papers made either by hand or machine bear these same markings—inherited from the Chinese craftsmen of nearly twenty centuries ago.

Before the invention of papermaking the Egyptians had for centuries been making papyrus, but this was a laminated substance and had no relation to true paper made from disintegrated fibre such as invented by Ts'ai Lun and his helpers. The construction of papyrus is more in the nature of delicate carpentry, as the material is built up by pasting together thin strips or slices of the plant stalks, very much as wood might be laminated for various uses where a strong, thin material is desired.

While almost two thousand years have elapsed since the invention of forming sheets of paper, the principle of the *modus operandi* remains almost identical, and in the great modern paper manufactories the same general methods prevail. It is customary to think of paper principally in connection with printing, but the process of forming sheets of paper in China antedates printing in that country by over 700 years. Printing had no influence upon the invention of paper either in the Orient or the Occident. Inasmuch as the first paper was fabricated for the purpose of writing, the sheets needed to be soft and absorbent so that the liquid pigment applied by the firm, wide strokes of the hair brush would dry rapidly. It was this transparent, absorbent Chinese paper, made essentially for calligraphy, that determined the method used in the first block printing, originated by the Chinese in the ninth century.

From China paper found its way into Central Asia and Persia by a route well known to the caravans which sought to open a road connecting the Pacific with the Mediterranean. This road was later mapped by Marco Polo in the thirteenth century, following the Gobi desert, the desert of Takla Makan, the Tarim valley, and finally arriving at Samarkand. Chinese paper made from bark and the fibres of rags and hemp may possibly have been imported and sold in Samarkand, but it is thought that paper was not actually made in Samarkand until after the year 751, the year a battle was fought by the Chinese in Turkestan on the banks of the Tharez river. It is recorded that among the Chinese prisoners taken in this conflict there were a number of skilled papermakers and their captors set these craftsmen to work fabricating paper. Up to this time the art of making paper had been a closely guarded secret in the country of its inception. The manufacture of paper was favored in Samarkand by the abundant crops of flax and hemp, as well as by the numerous irrigation canals, as plenty of pure water was then, as now, a necessary adjunct for paper production.

A 500-year journey

From Samarkand the craft of making paper spread to Bagdad and Damascus and finally into Egypt and Morocco. It required almost five hundred years to find its way into Europe from Samarkand as there was little communication between the East and the West. It is not known whether the craft was first introduced into Spain or Italy, each country having its own claimants; but, in any event, the first papermaking in Europe was accomplished in the twelfth or thirteenth century, or over a thousand years after its inception in China. The early paper of Europe was regarded with disfavor as it was not only higher in price and more fragile than parchment, the skin of animals that had been in use for book making, but it was distrusted on account of its

Judeo-Arabic origin. A fanaticism drove the Christian world to condemn, and even destroy, everything that suggested the Moslem civilization, although the European scribes no doubt knew that the newly introduced substance, paper, would eventually take the place of their cherished parchment.

The first watermarks

As has been previously shown, the first practical mould used in China for the forming of sheets of paper was made of thin, rounded strips of bamboo, laced together with hair. Moulds of this material could not be made in Europe where there was no bamboo. Therefore, the European papermakers devised moulds of wire, but retained the original form or design of the Chinese implement. While the Oriental makers of paper with their rigid bamboo moulds had never used watermarks in the form of symbols or designs, the European moulds, being constructed of pliable wire, lent themselves readily to the water-marking devices. The first watermarks appeared in European paper almost simultaneously with the introduction of papermaking and insofar as handmade paper is concerned the method of making these devices has undergone no change to the present day. Also the moulds used by the modern handmade papermakers retain the original formation of the "laid" and "chain" lines of the Chinese bamboo mould of the second or third century.

In Europe as well as in China the craft of making paper antedated the art of printing, so that in both the Orient and the Occident printing had no bearing or influence upon papermaking. In China, as has been stated, the first paper was made essentially for writing with a hair brush and for this purpose a soft absorbent paper was required. In Europe also the first paper was made for writing, but in this case by means of a hard quill pen, a method of calligraphy that required a firm impervious paper—the very opposite of that needed for the Chinese mode of writing. It was this heavy paper made impenetrable to fluid ink by being dipped in a sizing, or gelatine, rendered from the horns and hoofs of animals, that confronted the first European printers. Unlike the soft-fibred paper of China which would take an ink impression from a wood block with ease, the hard European paper had to be literally impressed into the wood block or type in order to produce a clear-cut impression. It was, therefore, the hard-sized linen and cotton papers of Europe that necessitated the invention of the printing press. In China, to this day, most of the printing is done from incised wood blocks; the raised carved surface of the flat block is covered with pigment, a sheet of paper is laid upon the inked surface and the paper rubbed gently by hand. With the soft absorbent papers of China, made from bamboo, straw and mulberry bark, the process of printing is accomplished in this simple and direct manner without difficulty.

From the very introduction of papermaking in Europe there was a scarcity of material such as old linen, cotton and hemp. In the fifteenth century, after the invention of printing from movable types, paper became more and more in demand and there was a constant shortage of materials from which paper could be made. It was fortunate at this period that the wearing of woolen underclothing gave way to the fashion of linen underwear, for it is said that this change of style contributed largely to the development of papermaking and had a decided bearing on the cost of the finished product. In some countries it was made an offense to export hemp, flax and rags as they were needed in papermaking; and it is recorded that at one time it was prohibited by law to bury a person clothed in either linen or cotton. The use of wool for this purpose was sanctioned, as this material has never been suited for the making of paper. While there was a certain prejudice existing against paper in the fifteenth century on account of its comparative frailty, it nevertheless definitely came to replace parchment due to its lower price and greater flexibility.

Wasp made first paper

Owing to the greatly increased demand for paper in Europe the scarcity of rags had become so acute by the beginning of the eighteenth century that René Antoine Ferchault Réaumur, a French scientist, who had made a twenty-year study of the life of the wasp, wrote for the French Royal Academy, in 1719, an entomological treatise in which his observations on the making of paper from wood were both practical and prophetic. It is well known that wasps make their nests from a kind of paper which they fabricate from wood, such as old fence rails, the stumps of trees and the like. The papermakers did not, however, accept Réaumur's suggestion, for this same plan was again brought to their attention by this scientist in 1742 when in another treatise on the same subject he reproached himself for having permitted more than twenty years to elapse without trying any experiments in the actual making of paper from wood fibres.

Not until the year 1765 were practical experiments made in fabricating paper from wood that remain as substantial evidence today. These experiments were carried on by Dr. Jacob Christian Schaeffer, Regensburg, Germany, who published successively during the years 1765 to 1771 a series of six volumes with specimen leaves showing the use of more than eighty varieties of material that could be used successfully for the making of paper. These examples include paper made from the wood of various trees and plants, stalks, leaves, barks, husks, tendrils, down and other plant forms; also, nettles, moss, potatoes and their skins, as well as many additional species of vegetation. Even with the pronounced shortage of linen and cotton rags very little paper was made from the materials offered in Schaeffer's books.

Following these experiments came the important work of Matthias Koops, in London in 1800, whose researches are substantiated by a book issued in the same year. Part of the paper used in the printing of this volume was made from straw and part from wood. It is the paper made from wood fibre, however, which gives importance to the discoveries of Koops, as this was the first instance in Europe where paper composed solely of wood was put to actual use in the printing of a book. The mission of this work was to acquaint the papermakers of Great Britain with the possibilities of a wider field for gathering papermaking materials, as there was an ever-increasing demand for paper, especially for common and ephemeral use, and the supply of linen and cotton rags had become by this time totally inadequate to equal this demand. Regardless of the early nineteenth century experiments made by Koops in England the British papermakers were slow to make use of the newly suggested materials, and it was left for German and American scientists to finally perfect, in the middle nineteenth century, the making of paper from wood—the substance that in modern times furnishes the material for the great bulk of the paper in daily use.

Printing increased paper output

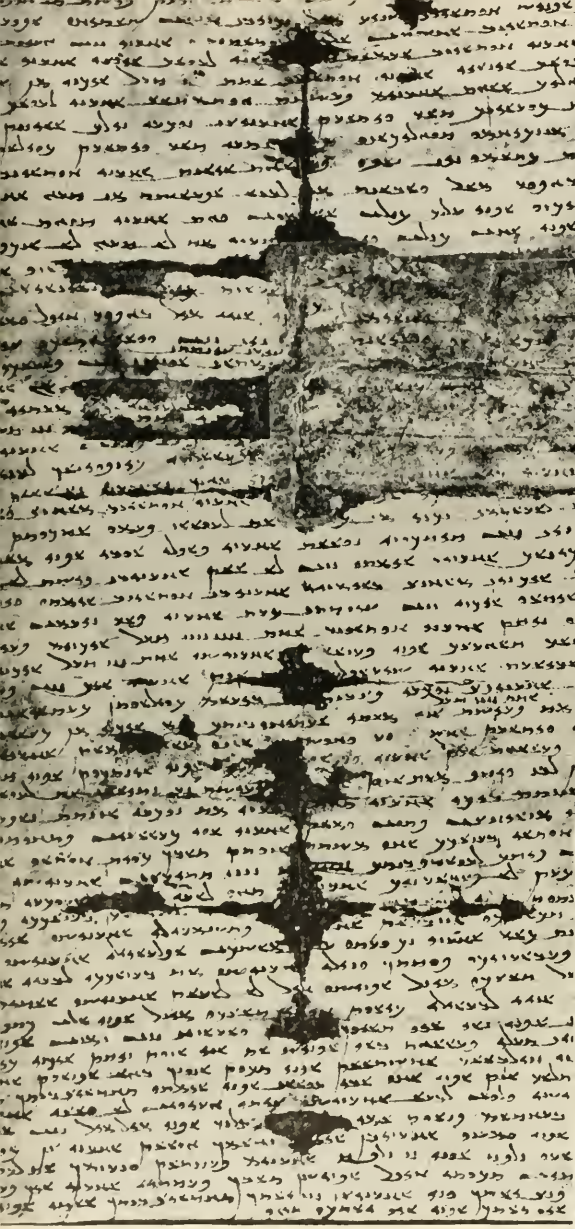
Until the invention of printing from movable types (1450-1455), there was comparatively little use for paper; but, after the new process of duplicating the written word was discovered, there were thousands of handmade paper mills in operation all over Europe, and in the late seventeenth and early eighteenth centuries a number of mills had been set up in America. Papermaking developed naturally along with the art of printing and it became almost impossible to supply the requirements for paper by the ancient hand process. Newspapers, books and magazines were everywhere on the increase, and the use of paper for purposes other than printing and writing was developing more and more. Paper was used in early years for packages and labels, and while its diversified employment in Europe has never equaled that of the Orient, paper, nevertheless, by the end of the eighteenth century had become such a dominant factor in the life of every person that it was absolutely necessary to seek a way to greatly increase its production. The hand mills, no matter how large or efficient, could not begin to supply the tremendous demand for paper. A more expedient manner of manufacture had become imperative. Various ingenious men tried to construct machines to make paper, but they were unsuccessful as their attempts were based on the principle of forming one sheet at a time as had been the hand method for hundreds of years, first by the Chinese and later by the Europeans. The earliest venture at devising a machine was along the line of an automaton, or mechanical man, in an endeavor to duplicate the motions and performance of a worker forming sheets of paper by hand.

Machines supplant hand mills

In the year 1798 Nicolas-Louis Robert, a Frenchman, invented the machine for making paper in "lengths of twelve to fifteen meters," but not until a year later was paper actually made on this small machine. At the beginning of the nineteenth century workable machines for the fabrication of paper in a continuous web were constructed in England. From this period onward the development of the machine was rapid and the ancient hand process gradually gave way to the new, until at the present time there are no more than thirty handmade paper mills in the whole of Europe, and in the Western Hemisphere none at all.

The handmade paper mills of Europe at the present time are operated solely for the production of papers with an aesthetic appeal—papers for use in limited editions of books and for the printing of fine etchings and engravings, as well as for the making of exclusive stationery. In the Orient, however, handmade paper is not a thing of luxury confined to the dilettante and the wealthy, but it is indeed an every-day commodity in use by all classes of people for many common purposes. For this reason there are thousands of handmade paper mills in operation throughout the Orient, and it is likely that in the Far East paper will always be made in this ancient, tedious manner.

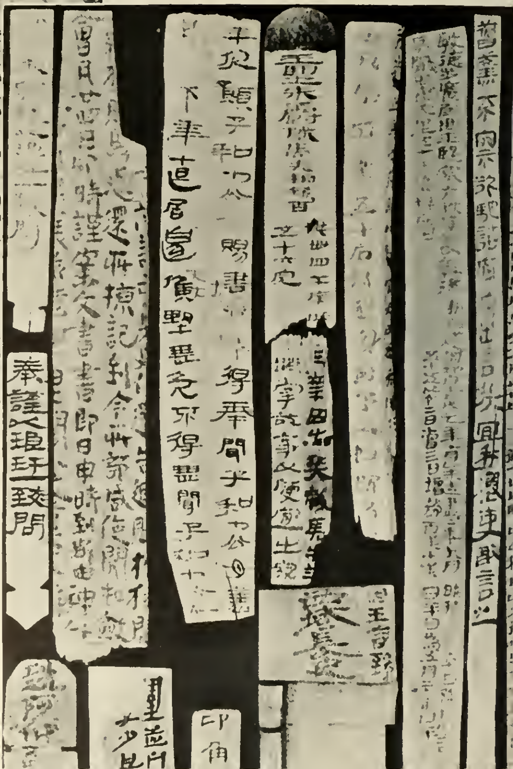
In Japan, as well as in Europe and America, there are fast running machines each producing hundreds of feet of paper per minute. But this delicate



A MANUSCRIPT FROM THE DAWN OF THE PAPER INDUSTRY: a specimen dating from about A.D. 150 found by Sir Aurel Stein in the ruins of the Great Chinese Wall. *(British Museum)*

The high cost of silk, which preceded paper as writing material, prompted its invention. Trimmings from the edges of silk manuscripts probably provided the first material from which paper was made, and the process employed followed principles of felt-making that were long known

Reproduced from "Old Papermaking in China and Japan," by Dard Hunter

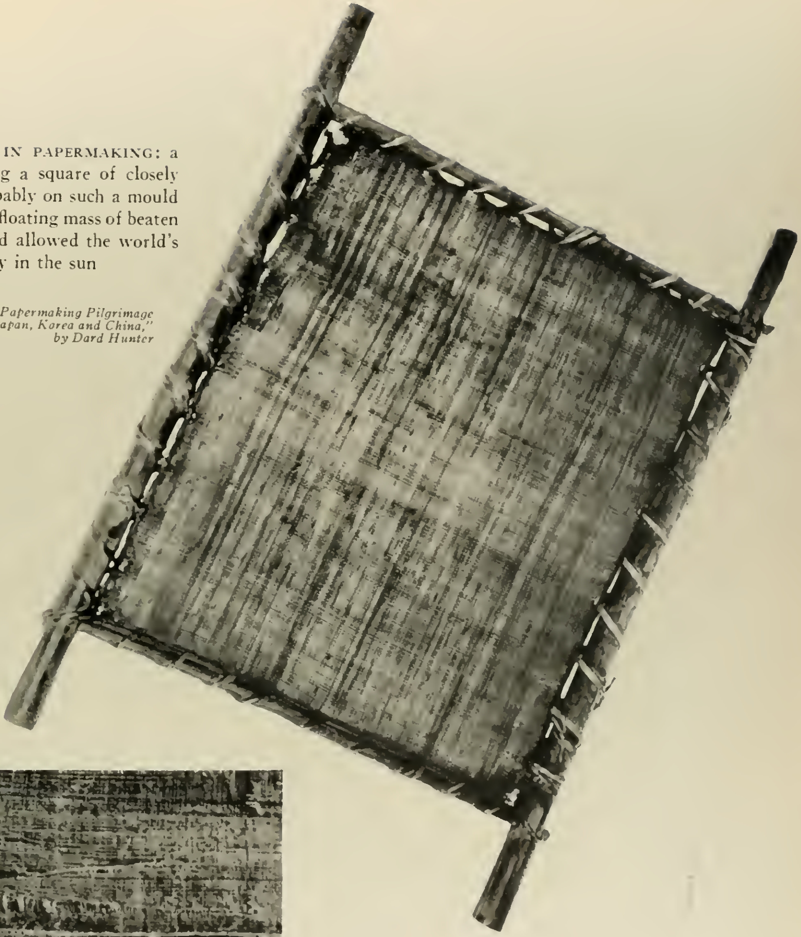


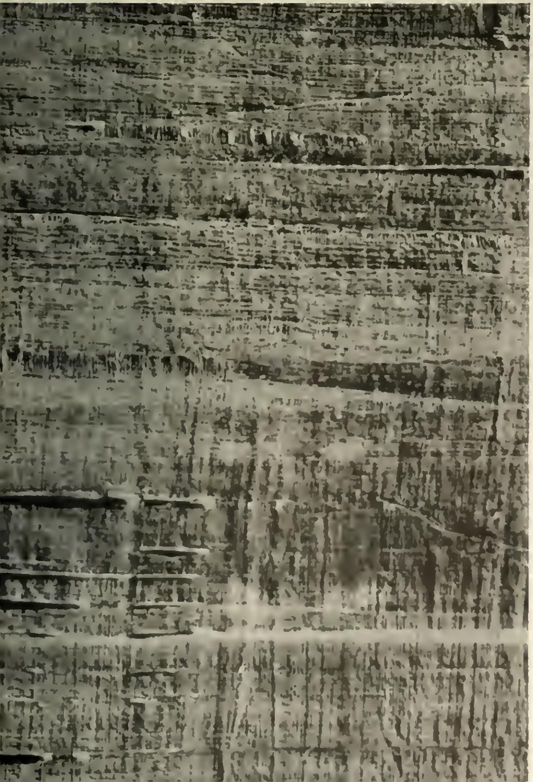
BEFORE THE INVENTION OF PAPER wooden tablets served as documents in ancient China. Only after many centuries of use was this cumbersome material replaced by silk cloth

From "Ruins of Desert Cathay," By M. Aurel Stein

THE BASIC INVENTION IN PAPERMAKING: a bamboo frame supporting a square of closely woven cloth. It was probably on such a mould that Ts'ai Lun lifted the floating mass of beaten fibres from the water and allowed the world's first sheet of paper to dry in the sun

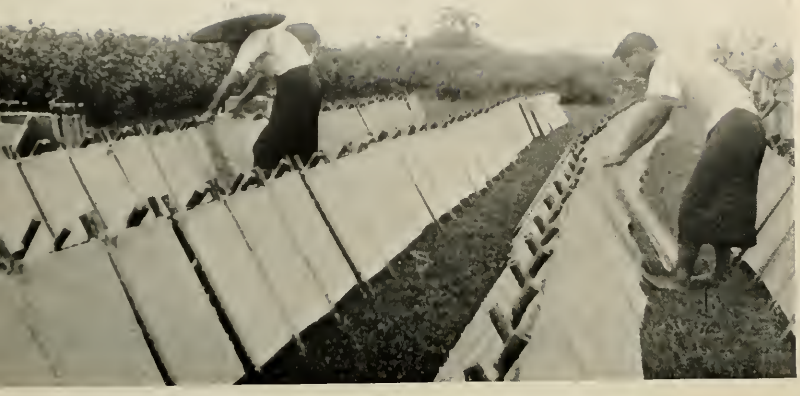
From "A Papermaking Pilgrimage to Japan, Korea and China," by Dard Hunter





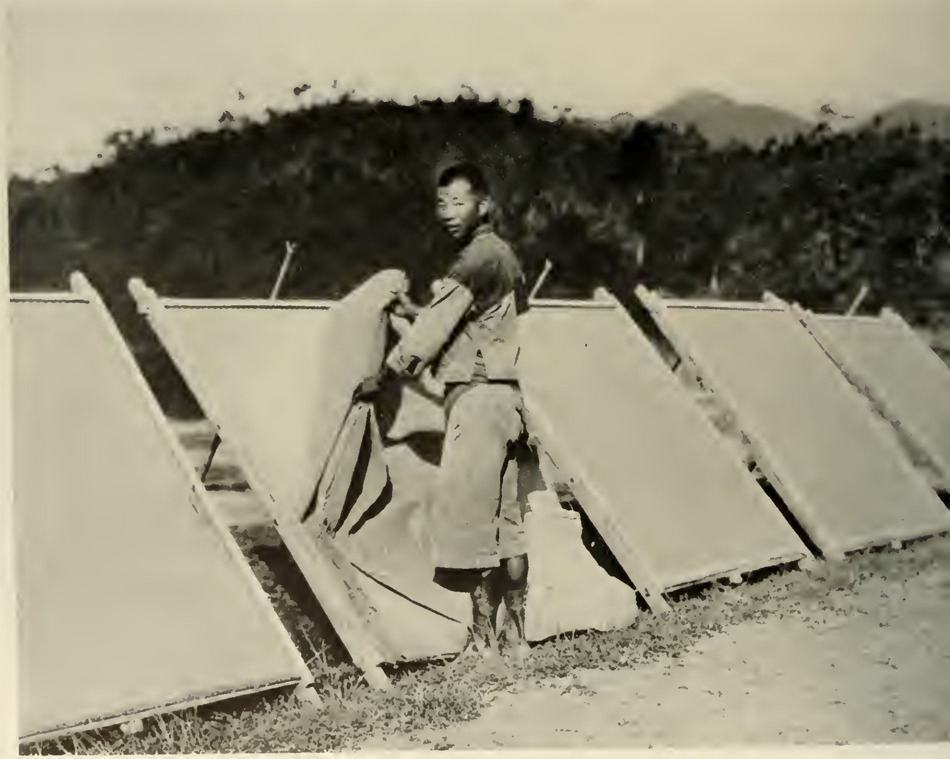
PAPYRUS: the writing material which the Egyptians used for centuries before the invention of paper, but which bears no relation to true paper as we know it. Papyrus is built up by pasting together thin slices of the plant stalks, and its manufacture resembles delicate carpentry rather than papermaking. Note the criss-cross "grain"

From "Papermaking in the Class Room" by Dard Hunter



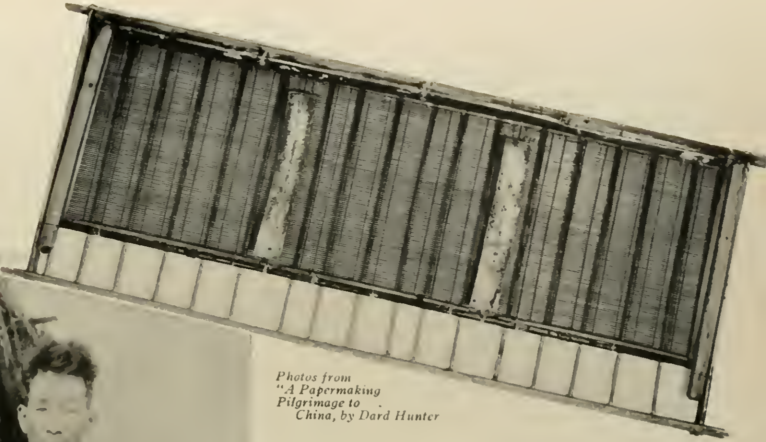
MAKING PAPER WHILE THE SUN SHINES. Just as in the first days of papermaking, the mould, with the thin deposit of felted fibres adhering to its surface, is placed in the sun to dry, in Kwangtung, China

Photos from "A Papermaking Pilgrimage to . . . China," by Dard Hunter



REMOVING THE PAPER AFTER DRYING: an ancient process widely used today. Unlike the cloth moulds shown in the upper picture, these are woven of rattan and leave a wicker-work impression on every sheet of paper

(Below) A MILESTONE IN THE HISTORY OF PAPERMAKING: a mould from which a sheet of paper could be taken while moist, enabling the worker to make sheet after sheet without pause

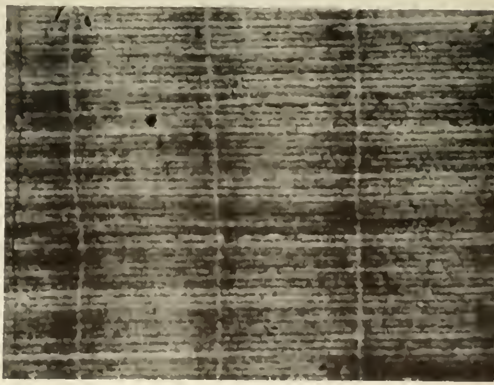


Photos from "A Papermaking Pilgrimage to China, by Dard Hunter

(Above) THE ORIGINAL "LAID" PAPER MOULD, from which a sheet could be taken while moist, was made of thin strips of bamboo laced together with hair

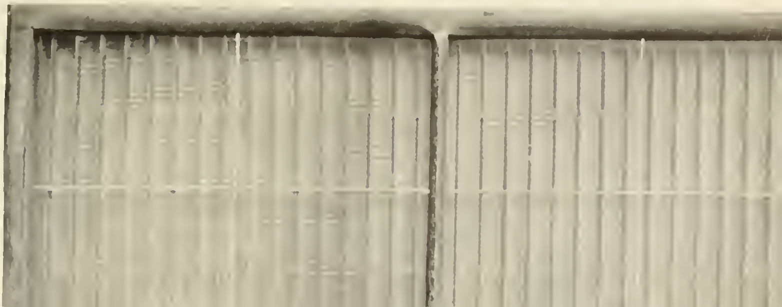
THE IMPRESSIONS left by the bamboo strips and lacing, as shown below, may be detected in the earliest known paper and are the forerunners of the modern watermark

From "Papermaking Through Eighteen Centuries," by Dard Hunter



(Right) BAMBOO BEING LACKING IN THE OCCIDENT, the first papermaking moulds of Europe were constructed of wire, but the same pattern of "laid" and "chain" lines was retained

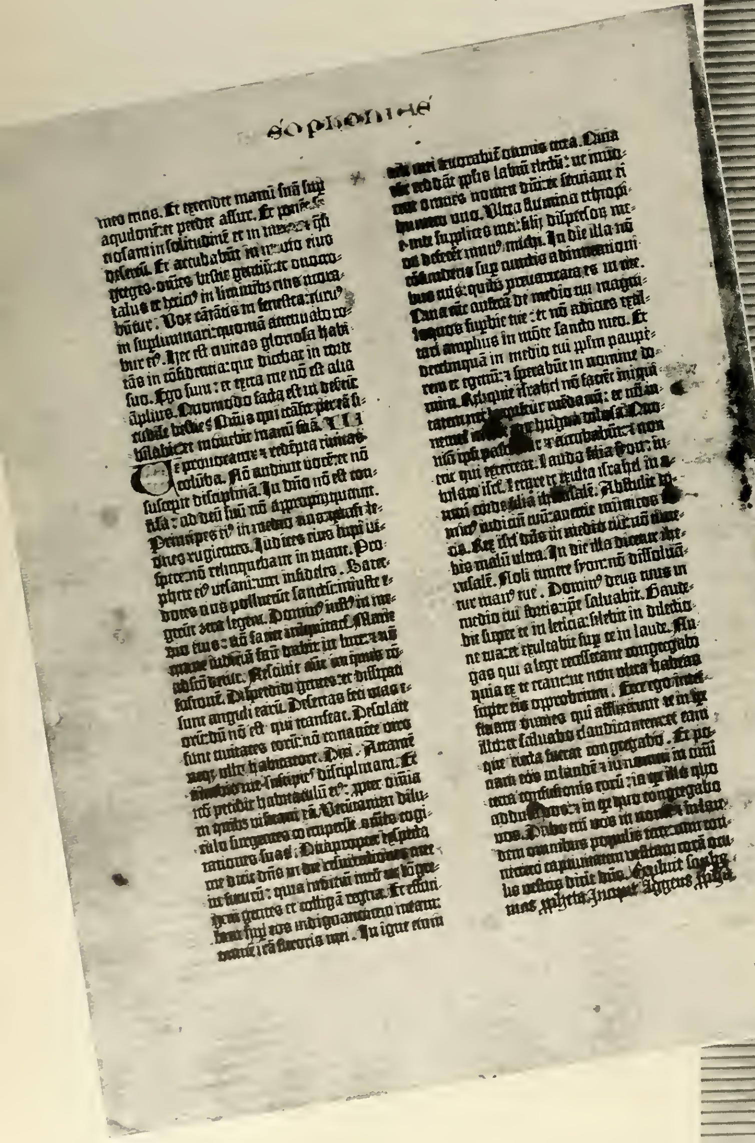
From "Papermaking Through Eighteen Centuries," by Dard Hunter

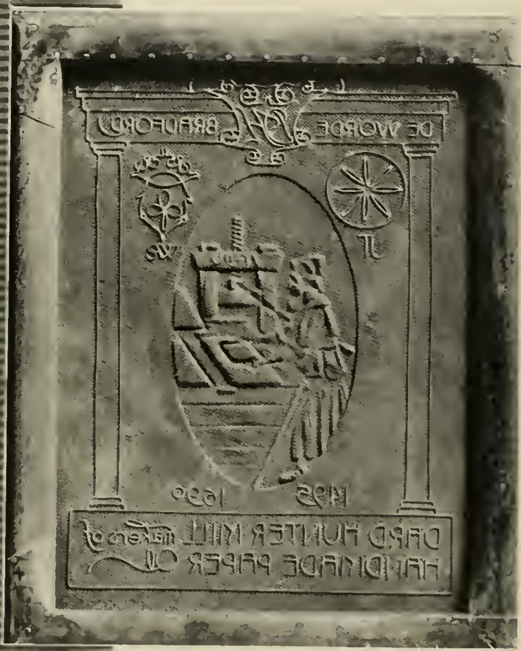


ORIGIN OF THE WATERMARK. Using wire instead of bamboo, the first European makers of paper moulds affixed twisted wire symbols to them which would leave their impression in the paper. The photograph at right shows the actual wire watermark design sewed to a 15th century mould: a bull's head and rose-of-bliss device

(Below) BUNCH OF GRAPES WATERMARK in the Gutenberg 42-line Bible (1450-1455)

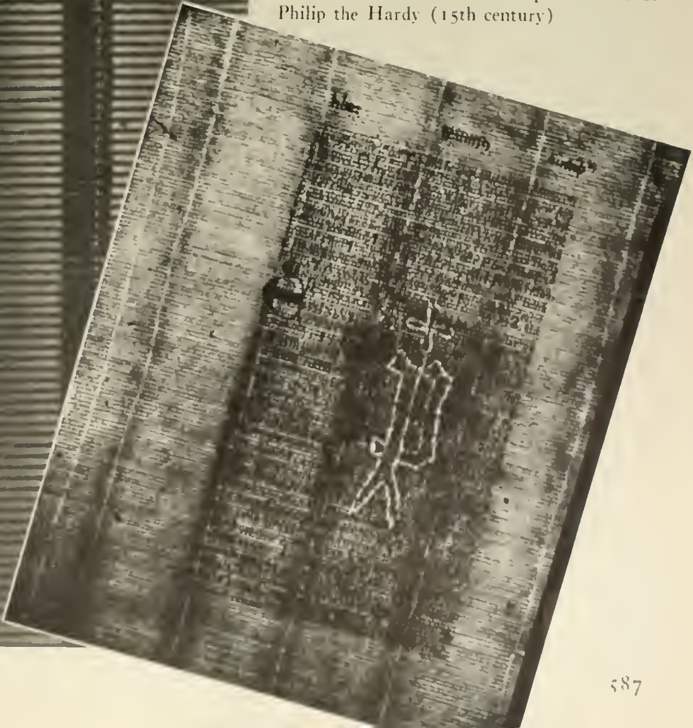
From "Papermaking Through Eighteen Centuries," by Dard Hunter
Courtesy: Encyclopedia Britannica

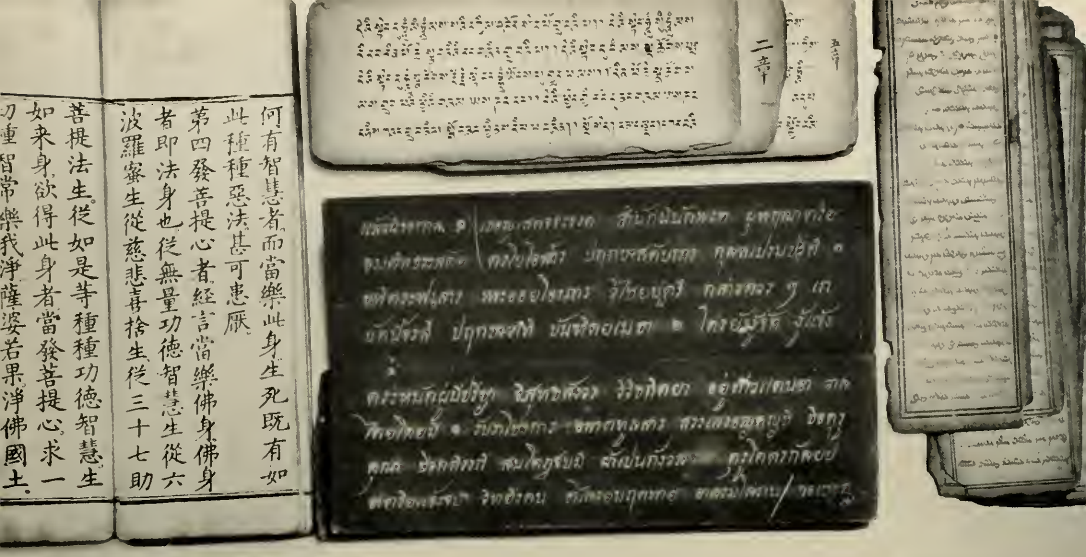



DE WORDE
BRADFORD
1495
1639
DARD HUNTER MILL
HANDMADE PAPER

A MODERN MOULD for making paper by hand. The lettering and symbols follow the 15th century mode; the light-and-shade device is a 19th century invention

(Below) "P" stands for Philip the Good or Philip the Hardy (15th century)



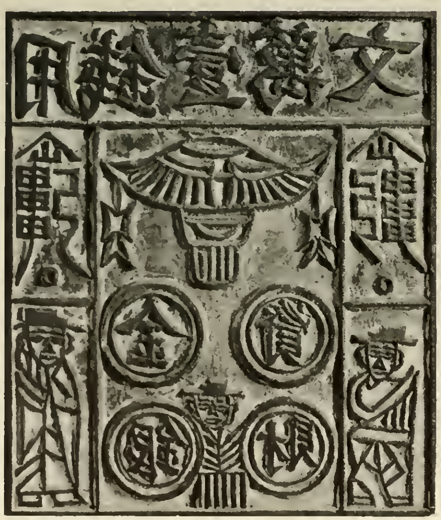


何有智慧者而當樂此身生死既有如
此種種惡法甚可患厭
第四發菩提心者經言當樂佛身佛身
者即法身也從無量功德智慧生從六
波羅蜜生從慈悲喜捨生從三十七助

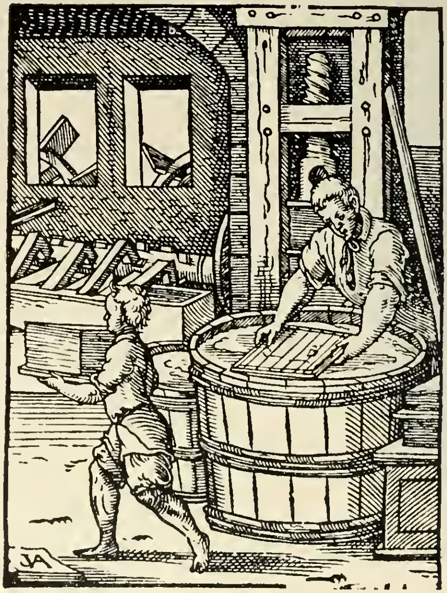
菩提法生從如是等種種功德智慧生
如來身欲得此身者當發菩提心求一
切種智常樂我淨薩婆若果淨佛國土

From "Papermaking in the Class-Room," by Dard Hunter

EARLY ASIATIC PAPER, as shown above, was made absorbent for writing with the hair brush and was well suited to printing with wooden blocks. Early European paper, however, being made impervious to ink for use with a hard quill pen, necessitated the invention of the printing press

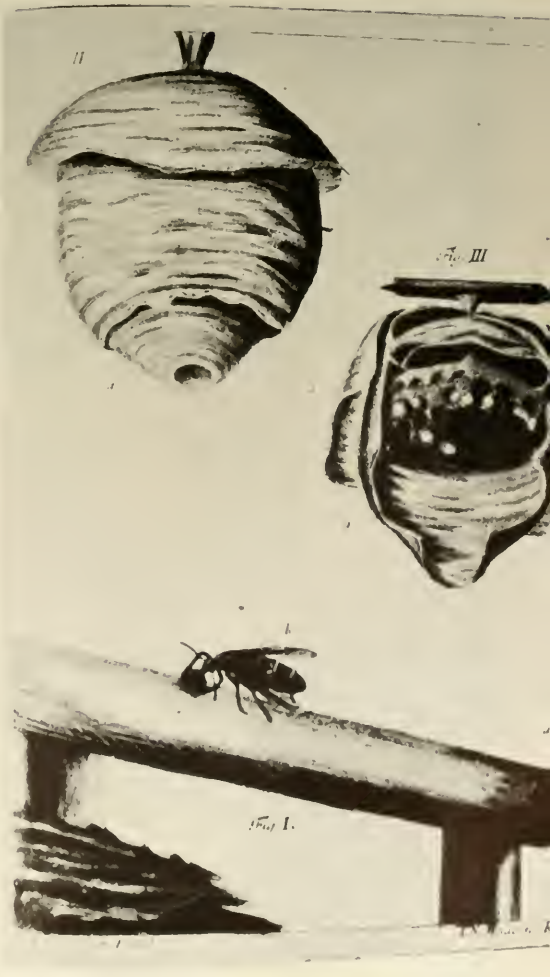


(Left) WOOD BLOCK FOR PRINTING CHINESE "SPIRIT MONEY" to be burnt in funeral ceremonies. Each sheet signifies: "Ten thousand cash for all time; treasure, gold, silver." In Chekiang province alone 200,000 persons are wholly or partially dependent on the making of ceremonial paper objects

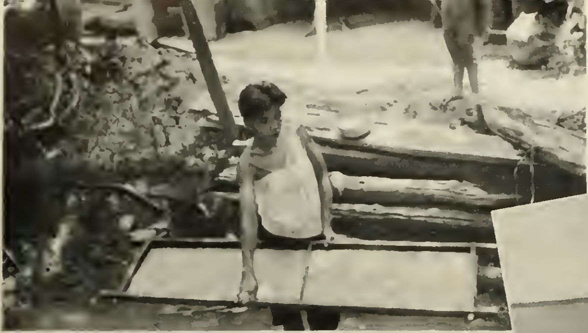


(Right) EARLIEST ILLUSTRATION in either the Orient or Occident depicting papermaking, published in 1568. The craftsman is lifting the film of floating fibres from the surface of the water, while his apprentice is carrying a stack of paper to where the sheets can be hung for drying. Note wooden trip-hammer mechanism of stamping mill for beating fibres, in background

(Above) NATURE'S PAPER: material manufactured by the wasp in the construction of its nest. Twenty years of study of the life of the wasp led the French scientist Réaumur to the discovery of making paper from wood

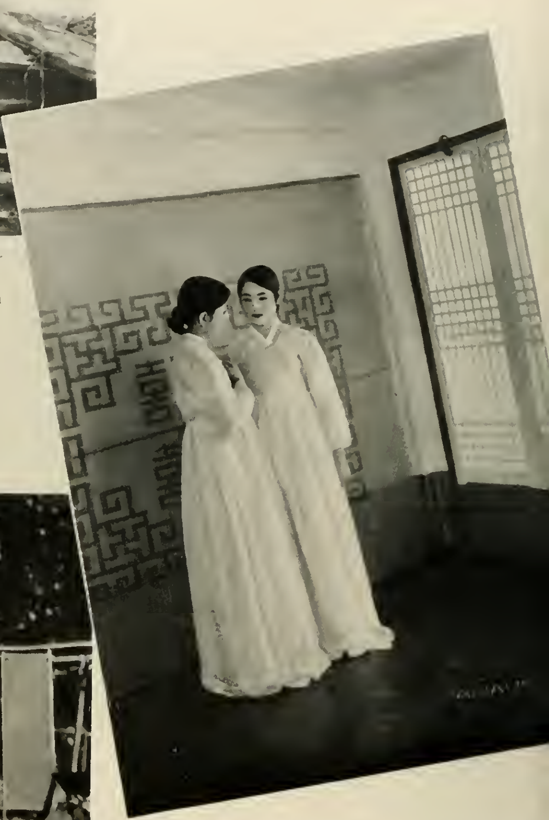


(Right) THE FIRST PAPERMAKER, the wasp, as illustrated in the treatise of Dr. Schaeffer, who in 1765 made the first practical experiments in fabricating paper from wood that remain as substantial evidence today

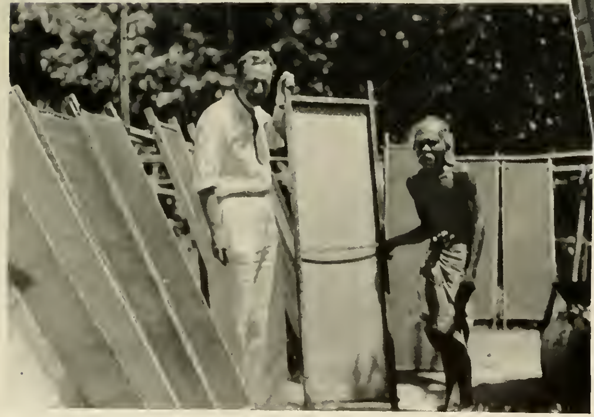


From "Papermaking in Southern Siam," by Dard Hunter

Making long sheets of paper in Bangsom, Southern Siam

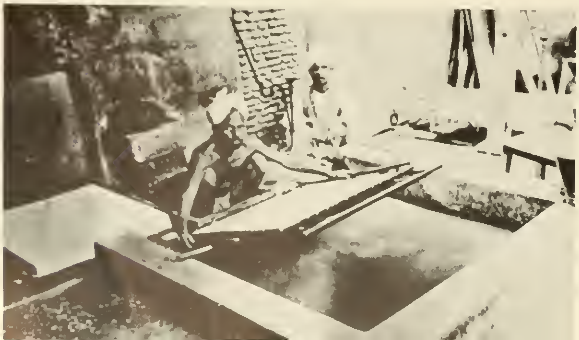


Paper windows made from the inner bark of the mulberry mellow the light of the Korean house



From "Papermaking in Southern Siam," by Dard Hunter

Temple paper of siam: Dard Hunter and Tym Niltongkum, the papermaker, holding a mould at Bangsom



Making paper in india. The same principle of technique prevails throughout the Orient

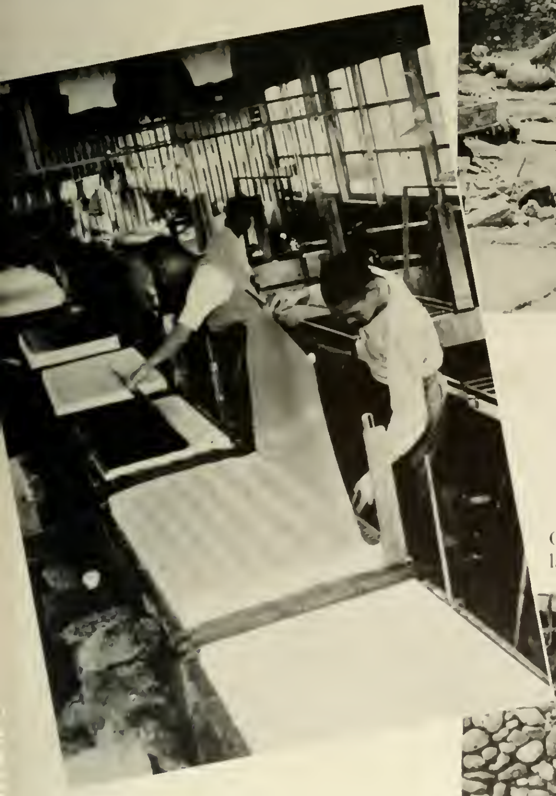
From "Papermaking Through Eighteen Centuries," by Dard Hunter

A VILLAGE OF PAPERMAKERS: Ompei, central Korea, where the entire population is engaged in the paper craft

All photos from "A Papermaking Pilgrimage to . . . China," by Dard Hunter

PAPER CARPET. This heavy paper is destined for use on the floors of houses in Korea

(Below) FORMING SHEETS OF PAPER in Japan made from the inner bark of the paper mulberry. This paper is exported to the Occident, where it finds many uses



OPEN AIR PAPER FACTORY on the stream in the paper village of Ompei, central Korea

A MODERN FRENCH handmade paper mill. There are no more than 30 handmade paper mills in all Europe, and in America, none

From "A Paper Making Pilgrimage to . . . China," by Dard Hunter

A PULP GRINDING STONE formerly used in Korea. Papermaking was introduced into Japan by way of Korea in the 7th century

A MODERN COUNTERPART of the grinding stone shown above: the "chipper" of an up-to-date paper mill. A log is seen entering at the right, and the chips emerge on an endless belt in the background. Wood is the commonest substance used today, but it does not make the best paper

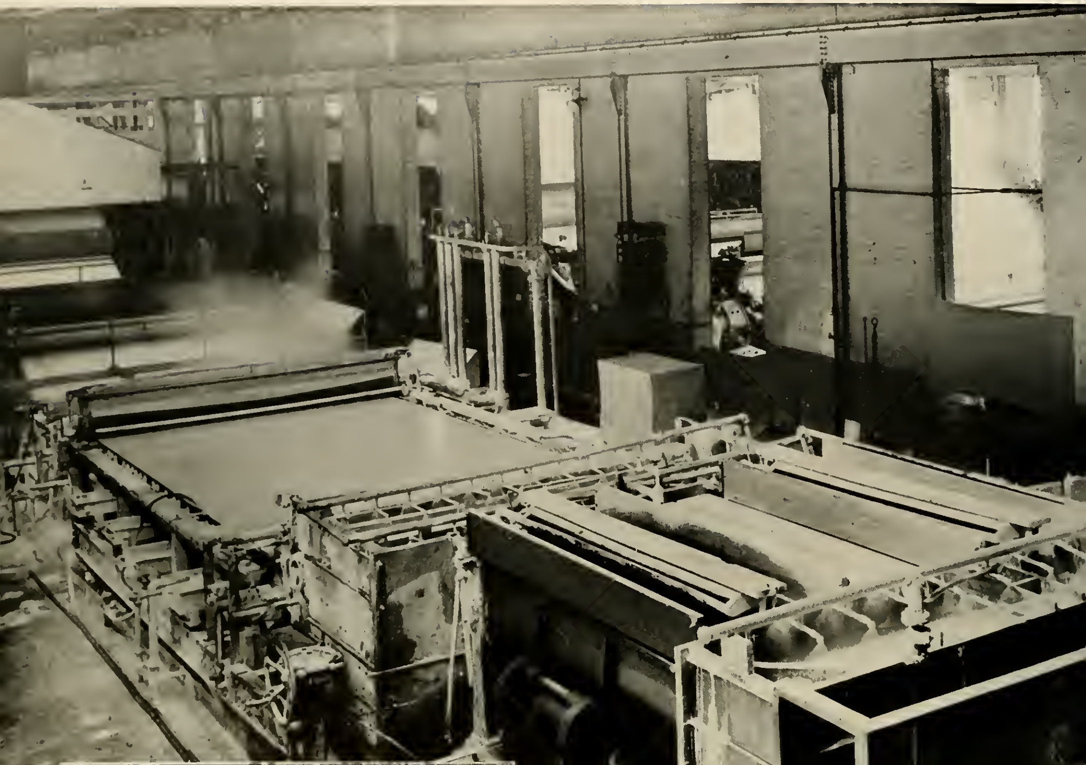
Courtesy: The Mead Pulp and Paper Company, Chillicothe, Ohio

THE BEATING OF MULBERRY BARK for the making of paper in Japan is often done by hand.

Photos from "A Papermaking Pilgrimage to . . . China," by Dard Hunter)

MACERATING MATERIAL IN KOREA. Age-old principles are used in modern paper mills, but only in the Orient is the work done extensively by hand

PERFORMING THE SAME WORK in American mills that is done by hand in the Orient, this modern high-speed beater macerates the materials used in the making of paper



A MACHINE FOUNDED on the ancient hand mould of China: the "wet end" of a modern Fourdrinier papermaking machine

(Left) REMINISCENT OF THE OLD Japanese prints, the papermakers at Najio, Japan, sit while forming sheets of paper in their moulds

From "A Papermaking Pilgrimage to . . . China," by Dard Hunter

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DIAGRAM showing how paper is made on a modern Fourdrinier machine

Courtesy: The Hammermill Paper Company

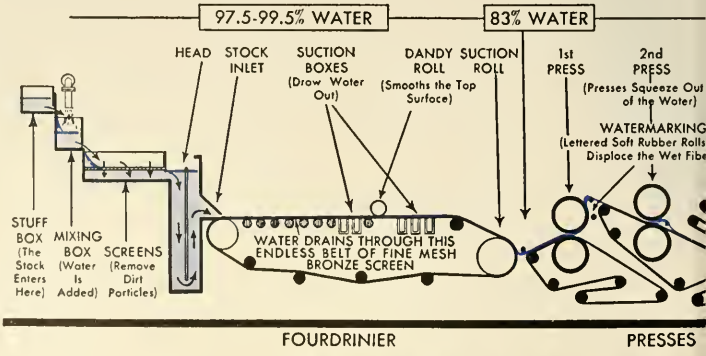
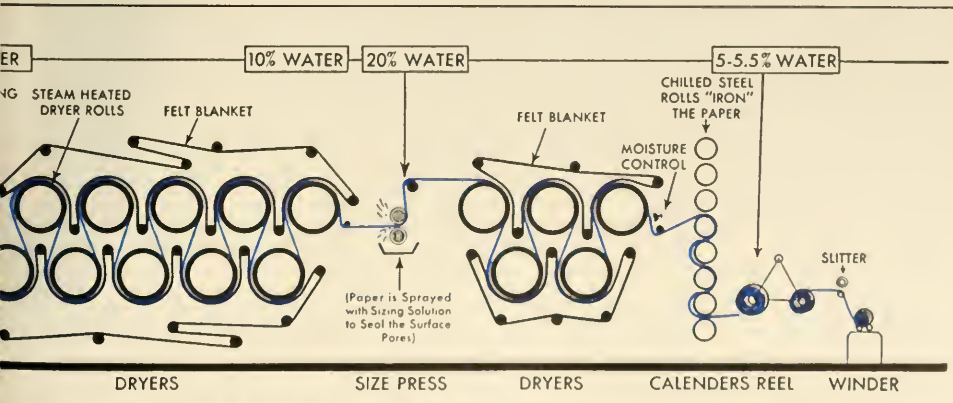

97.5-99.5% WATER
83% WATER
HEAD
STOCK INLET
SUCTION BOXES (Draw Water Out)
DANDY ROLL (Smooths the Top Surface)
SUCTION ROLL
1st PRESS
2nd PRESS (Presses Squeeze Out of the Water)
WATERMARKING (Lettered Soft Rubber Rolls Displace the Wet Fibe
STUFF BOX (The Stock Enters Here)
MIXING BOX (Water Is Added)
SCREENS (Remove Dirt Particles)
WATER DRAINS THROUGH THIS ENDLESS BELT OF FINE MESH BRONZE SCREEN
FOURDRINIER
PRESSES

DIAGRAM SHOWING HOW PAPER IS

(Right) PRIMITIVE PRESSES such as this are used even in the largest handmade paper mills in Japan

(Right below) AFTER LEAVING THE PRESS, the moist sheets are pasted on boards for drying

(Below) THE "DRY END" of the machine shown opposite, which performs the same operations as are done by hand in the adjoining pictures. This huge mechanical monster, though it cost hundreds of thousands of dollars, is not capable of making as strong or enduring paper as the small, primitive hand mills of China and Japan


ER
10% WATER
20% WATER
5-5.5% WATER
NG
STEAM HEATED DRYER ROLLS
FELT BLANKET
FELT BLANKET
CHILLED STEEL ROLLS "IRON" THE PAPER
MOISTURE CONTROL
SLITTER
(Paper is Sprayed with Sizing Solution to Seal the Surface Pores)
DRYERS
SIZE PRESS
DRYERS
CALENDERS
REEL
WINDER

MODERN FOURDRINIER PAPER MAKING MACHINE

and easily torn machine-made paper would not endure the ordeal to which the Japanese subject their thin, but hardy, handmade papers in the making of windows, lanterns, partition screens, umbrellas, raincloaks, bags, tarpaulins, and all manner of other requirements where glass, metal, leather and cloth are employed in the Occident. The general impression existing among Western people is that Japan has a mild climate and that, therefore, more delicate and fragile objects can survive, but this is not the case, as both summer and winter in Japan are most severe and are trying even to an American accustomed to rigorous winters and to summers that are damp and warm. It is only through the use of superior and unique papermaking materials and genuine ability in the craft of paper fabrication that the Japanese are able to make papers that give faithful service through long periods, being used over and over again. It is not uncommon to see paper umbrellas that have been in use for many years, and any traveler knows that Japan could never be called a rainless country. The observant wayfarer who has sojourned in the mountainous little island during the spring months is cognizant of the hardships the paper umbrellas must undergo, for it often rains for several days without interruption; and no matter how wet and damp it may be the people are always walking through the rain-soaked rice fields with their stilted wooden sandals and their charmingly colored paper umbrellas.

Paper tarpaulins

Along the country roads and lanes of Japan it is interesting to watch the great variety of man- and horse-drawn carts laden with every kind of native commodity, each with its paper tarpaulin. Every little cart has this oiled paper protection, impervious to water and lighter in weight than cloth, which during sunny weather is folded and packed away in the vehicle. These seemingly fragile paper covers will endure the trying conditions they are subjected to year after year and finally wear out only through constant use, as any other supposedly more durable material. The jinrikisha men in the towns and villages during the periodical rains wear mantles of oiled paper, for this material is not only effective in keeping them dry but may be purchased in large pieces for a few cents, and the sturdy little men who draw the comfortable, high-wheeled carriages are not affluent.

The workers in the fields, the men laboring on the roads, and the watchmen at the railway crossings depend upon coverings of paper to keep them dry. The oiled paper of Japan may be purchased in the smallest of shops, and every peasant cottage has a small stock of sheets of divers sizes which are used over and over for many household requirements. In the districts where tea is cultivated stout oiled paper bags are used for holding the leaves, and it is not unusual to see sacks that have given service for half a dozen years, literally covered with patches of paper where they have been repaired from time to time. Paper bags for the storing of grain are also common, for paper that has been oiled or tanned with the fermented juice of green persimmons is not easily destroyed by insects. The Occidental traveler never ceases to wonder at the almost unlimited use of paper by the Japanese; their expert adaptation of paper even exceeds in ingenuity the skill of the Chinese and Koreans.

A great portion of the Japanese handmade paper that is exported to the Occident is put to use for most utilitarian purposes, such as electric insulation, coverings for sausages, facial tissue, filtering, and all manner of prosaic requirements.

Paper carpet

In native Korean house building, paper plays a part that is unique, for in place of the regularly shaped mats used on the floors of Japanese houses, the Koreans use thick oiled paper, a thoroughly practical material when their method of heating is considered. In Korea the rooms are kept warm not by the picturesque *hibachi*, or charcoal bowl, of Japan, but by ovens directly under the floor. The smoke is emitted by way of a tile chimney running underground and finally rising within a wall at a considerable distance from the house, though in lowly houses it escapes directly from the foundation without the bother or expense of a tile chimney. In Korea, as in Japan, paper is used for windows and in many parts of China it is also used for this purpose. The Chinese use great quantities of paper made from straw and bamboo for the lining of clothes and in the making of their shoes.

Throughout the Orient paper holds a prominent place in all manner of ceremonies and festivals, and numerous native handmade mills are kept in operation through the manufacture of special papers for such purposes. In China vast quantities of these papers are fabricated to be converted into spirit money, tapers, incense wrappers, fire-crackers, and to satisfy many other ceremonial requirements. In the Far East paper has a sacred significance that is without a counterpart in the Western World. In Japan plain pieces of paper are folded neatly and placed in the temples, as paper even devoid of writing may be offered as a prayer. In the Japanese language the word *kami* means both God and Paper. In the great papermaking province of Echizen, on the northern coast of Japan, there is a beautiful Shinto shrine dedicated to the Echizen papermakers. The art of making paper was introduced into Japan from China by way of Korea in the seventh century and it was not far from this fascinating shrine that the first Japanese paper was fabricated. The lovely old grey group of wooden buildings is set on a quiet and lonely hillside amid giant evergreen trees through which penetrate thin streaks of light casting weird patterns upon the moss-covered roofs of this inspiring shrine—the most impressive sanctuary in the world dedicated to the craft of papermaking.

Funeral offerings

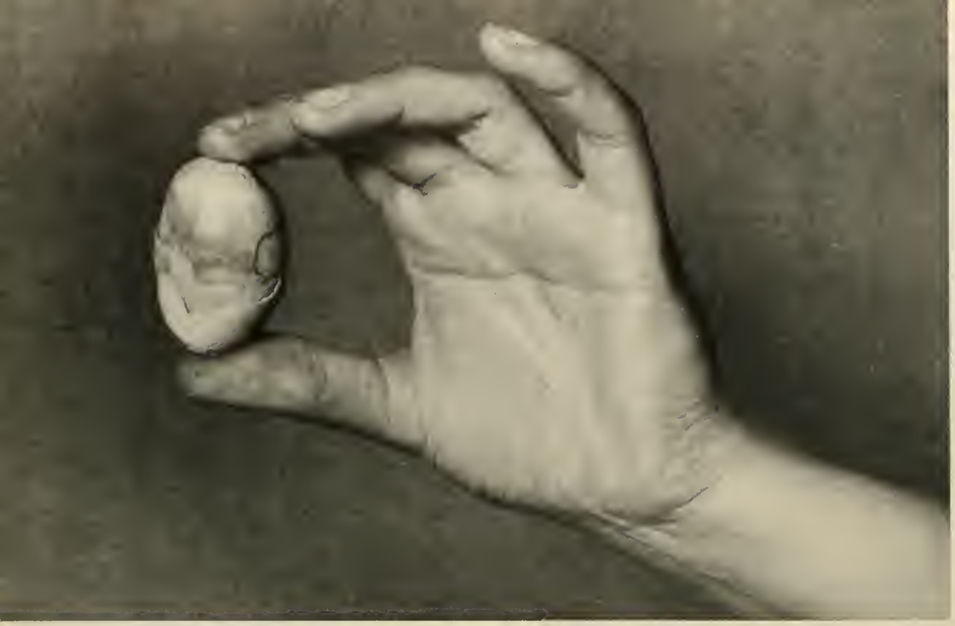
The use of ornamental paper cut to represent various objects and burnt at Chinese funerals dates from the very inception of papermaking and has continued through the centuries to this day, and each year thousands of reams of paper are consumed by the flames in ceremonial offerings. Objects of all kinds are constructed of paper and burnt at the bier of the deceased so that the departed spirit may have an abundance of the things represented by the frail paper effigies. Along certain streets of all great cities of China, as well as in the large communities in Asia where Chinese people reside, there may be seen the open shops, usually clustered three or four together, where these ghost-like replicas are fashioned—highly ornate cardboard chests with shiny gold and silver paper locks, flowing robes of paper painted with golden dragons and complicated patterns, shoes, hats, and all manner of wearing apparel made of paper. For the relatives of the wealthy the craftsmen in paper also construct full-sized carts, horses, and even automobiles, the thought being that when these fragile representations go up in smoke they will eventually assume reality in Heaven and the deceased will have horses and vehicles at his disposal. Everywhere such paper animals, paper clothing and other objects made of paper, go up in smoke at Chinese funeral ceremonies, yet the number of them is insignificant when compared with the quantities of mock-money burnt every year in China and all over Asia where Chinese have made their homes. It is probably reasoned by many Chinese that if sufficient "money" is burnt the deceased relative or friend will be able to purchase elaborate clothing, fine horses, and other necessities after reaching the spirit world, and that it is, therefore, not essential to burn paper replicas. In the one province of Chekiang more than 200,000 people are wholly or partially dependent upon the making, decorating and selling of paper used for sacrificial purposes.

Ancient and modern paper

Almost two thousand years have gone by since the first sheets of paper were formed by Ts'ai Lun and his colleagues, but over this long period, as has been shown, the principle of the technical operation remains precisely the same. Likewise the materials used in making paper have undergone few changes. In the days of Johann Gutenberg, the inventor of printing from movable types, paper was made from rags, and this waste material has always been used in the Occident in manufacturing the finest papers. In Asia the barks of the mulberry, mitsumata, and gampi, as well as bamboo and straw, are now the chief materials for the making of paper, and these same substances have been employed in the Orient for hundreds of years. It is only natural that the production of paper has kept abreast of the ever-increasing demand, but as far as strength, durability, and permanence are concerned the papers of the fifteenth century equal, if not excel, those manufactured in modern times.

Books consulted in the compilation of this article:

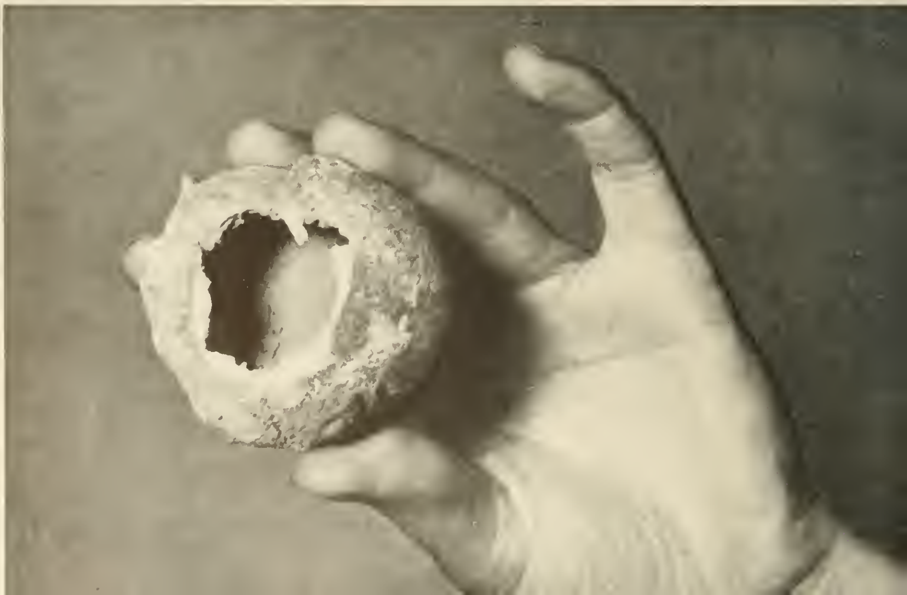
Old Papermaking in China and Japan, by Dard Hunter (1932); *The Origin of Paper*, by Andre Blum (translated from the French by Harry Miller Lydenberg) 1934; *A Papermaking Pilgrimage to Japan, Korea and China*, by Dard Hunter (1936); and *Chinese Ceremonial Paper*, by Dard Hunter (1937).



(Above) A 25,000-YEAR-OLD BEZOAR STONE, formed in the body of a prehistoric animal: a rare object which in Queen Elizabeth's time might have been set in gold and hoarded among the royal treasures as a cure for poisoning. Mistaken at first for a fossil egg, this stone, found in Nevada by Fenley Hunter and Albert Silberling, was identified at the American Museum as the first fossil bezoar ever recognized. Bezoars are sadly familiar to us under other names —gall-stones, kidney-stones and the like—and are simply the hard mineral or salt deposits medically known as calculi

THE 10-MILLION-YEAR-OLD FOSSIL BEZOAR illustrated below was found in Nebraska by Albert C. Thomson of the Museum staff, and probably belonged to one of the larger animals of the time, such as extinct rhinoceros, horse, or camel

The bottom has long since fallen out of the active market for bezoar stones, but these two specimens will remain among the most prized possessions of the Museum because they are the most ancient and extraordinary examples known



BEZOAR STONES—*Once they were prized by superstitious monarchs as a remedy for poisoning; interest now surrounds two specimens that were produced in the bodies of prehistoric animals*

By GEORGE GAYLORD SIMPSON
Associate Curator of Vertebrate Palaeontology
American Museum of Natural History

WHEN James I acceded to the throne of England, an inventory was taken of the crown jewels passed down to him from Queen Elizabeth. In this inventory there appear the curious items "one great Bezar stone, set in goulde," and "one other large Bezar stone, broken in pieces."

These bezar, or as we usually say, bezoar stones (pronounced beé-zor), so valued that they were set in gold and were hoarded among the treasures of the throne, were dingy and unattractive objects. They ranked with diamonds, sapphires, and rubies not for their beauty but for their costliness and, so it was thought, their unique virtues. Various medicinal values were long assigned to all the precious stones, and the bezoars were counted among these because they were reputed to be an infallible remedy for any sort of poisoning. Their price was such that only nobles could afford them, but this was no great hardship for in those days it was the royalty and nobility that were particularly in need of an antidote for poison.

Bezoars shared this purpose with unicorn horn. A piece of unicorn horn dipped into a drink detected the presence of poison, or a cup made of unicorn horn absorbed the poison and rendered it harmless. If these precautions failed and active poison was drunk, a piece of bezoar was swallowed as a cure. This legend was derived from the East and bezoars became known in Europe at the time of the crusades. The word "bezoar" is derived from Persian, by way of Arabic, and means "expelling poison."

Supposed source

Early authorities disagreed as to the source of bezoar stones. The most picturesque belief was that the stones came from deer that had been so indiscreet as to eat poisonous snakes. The consequent suffering of the deer brought tears to their eyes, the tears congealed as stones beneath their eyelids, and when these stones dropped out they were gathered up by men and were bezoar stones. Thus from the poisoned deer was engendered a preventive for what ailed them—a theory logical enough in itself and suggestive of our preparation of vaccines and serums. This theory as to bezoar stones had, however, the drawback of being entirely false.

There were other stones supposedly derived from animals and the distinction between these and the bezoar was not always clear. There was, for instance, the toadstone, believed to come from the head of a toad, as recorded by Shakespeare in "As You Like It":

> ". . . The toad, ugly and venomous,
> Wears yet a precious jewel in his head."

Other magic stones

Like the bezoar, the toadstone was a remedy for poison and it had the added virtue of becoming hot when poison was near, so that it served both as a warning and as an antidote. This is an example of sympathetic magic for, as Shakespeare's lines also recall, the toad was supposed to be deadly poisonous and to engender the stone as a remedy for its own offense. Homeopathists would do well not to smile at this absurd superstition. There were also madstones and snakestones, on more or less the same principle but differing in being applied externally to the wound, where they absorbed the poison. Another medicinal stone, the alectorian, was supposed to be derived from caponized roosters, but it had quite different virtues. It was not good for poison but prevented thirst and brought luck in games and in love.

The bezoars of commerce probably did not all have the same origin. Like unicorn horn, their qualities were really fictitious, so that anything that could pass as a unicorn horn or as a bezoar was as good as anything else. Moreover it was generally known that false bezoars were often sold, an imitation of something that was itself spurious, thus plumbing the depths of quackery. Even the objects that passed as bezoars with no conscious faking differed widely. Some were coprolites, fossilized excrement of prehistoric fishes and other creatures. Others were matted hair balls such as often accumulate in the stomachs of animals. True bezoars or what were called Oriental or East-Indian bezoars were real objects and really did come from animals, however fictitious were their properties and the other details of their origin.

These true bezoar stones are sadly familiar to us under other names: gall-stones, kidney-stones, and the like. They are simply hard mineral or salt deposits—doctors call them calculi (singular, calculus)—deposited in various cavities in the body. Besides those mentioned, humankind is also frequently affected by stones in the bladder, salivary glands, or pulp cavities of teeth. Apparently all kinds of animals have such stones on occasion and there is hardly any part of the body where they cannot form. They have been found in horses, rhinoceroses, deer, sheep, goats, camels, llamas, dogs, cats, rabbits, mice, birds, turtles, snakes, toads, fishes, and many others. They may occur in the gall-ducts, kidneys, bladder, salivery glands, tooth pulp, pancreas, intestines, udder, or indeed almost any place where there is any space for them.

Common as these calculi are, they usually mean trouble and are involved in illness. Something has gone wrong with the chemistry of the body, and substances that should be carried off in solution have instead been deposited in a solid mass where they should not be. Some fish have the peculiarity that calculi are not only normal but necessary to them: these are ear-stones (otoliths) that occur in the inner ear and help in the sense of balance. With this exception, however, the stones do no good and often they are extremely harmful. Thus the precious bezoars, like pearls (which are formed in much the same way and might indeed be called oyster-bezoars), are a product of disease.

Five-pound bezoars

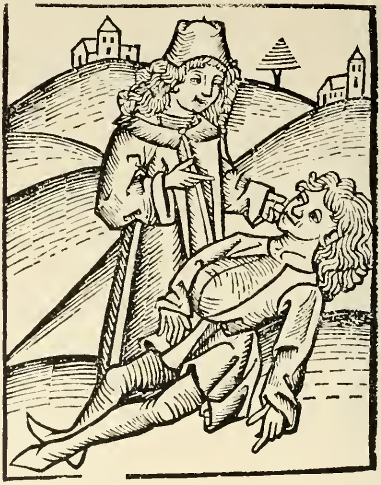
Their shapes and sizes vary greatly. Often they are spherical or egg-shaped, but they may be pyramidal or may be extremely irregular. Spherical stones weighing up to five pounds have been found in the intestines of horses. Sometimes they resemble, in miniature, the formations seen around geysers or caves and would then be of some beauty could we rid ourselves of unpleasant associations with their mode of formation. In composition, too, they vary widely. Many have the same composition as ordinary limestone while others are more complex, salts of ammonia, magnesium, etc., or phosphates of various sorts.

Most of the genuine bezoars of our ancestors were derived from the intestines of goats. Oriental bezoars, the most valued kind, usually came from wild Persian goats. One sign of their being genuine was to cut them in two, when the internal structure should be banded with concentric rings like an agate. This effect is produced by their being deposited in layers and is often true of calculi, no matter in what part of whatever animal they may have been formed.

Bezoar's power tested

One of the classic anecdotes of medical history is that of Charles IX of France, his surgeon Ambroise Paré and the bezoar stone. Charles, who seems to have had infinite faith in magic but none in his fellow man, always had his wine tested for poison with unicorn horn (probably in his case a piece of narwhal tooth) before he drank, and to be doubly safe he kept a bezoar on hand. Paré, much to his credit, had no faith in bezoar stones as remedies and resolved to test their power by poisoning a criminal and then administering the bezoar. Presumably if the anti-vivisectionists have their way and prohibit such experiments on animals, they will return to the use of men instead, perhaps volunteering themselves, for only by experimental methods can superstitious and quack remedies be tested and truly useful medical procedures be discovered.

Paré lived in the much vaunted Age of Faith. Everyone just "knew" that bezoar stones were an antidote for poison and the simple idea of trying it



Use of bezoar stone in a case of poisoning
(From Hortus Sanitatus, published in Strassburg in 1497)

out was sensational because it had never occurred to anyone.

The human guinea pig of this experiment was a thief condemned to death. He was given his choice between certain death by strangling and possible life by being poisoned and then treated with the king's bezoar. Naturally he chose the latter, especially as he "knew," like everyone else but Paré, that the bezoar was a sure cure. He was given the poison, probably corrosive sublimate, and the bezoar, and he died after hours of agony. Paré was convinced, and probably the criminal was convinced before he died, that bezoars have no medicinal value, but faith dies hard. The king merely concluded that his bezoar was a fake and he ordered another.

There is no record of a bezoar stone ever actually curing anyone of anything and there is abundant evidence of its failure to do so, yet faith in it continued almost to our own day. Lest we feel far removed from such silly beliefs, remember that Oliver Wendell Holmes recorded a gift of an East-Indian bezoar from Governor Endicott to Governor John Winthrop and expressed a fervent hope that it was genuine, "for they cheated infamously in the matter of these concretions." Indeed equally ridiculous ideas are still firmly held by nominally educated people.

A rain-maker

In the East, belief in the efficacy of bezoars is said still to be widespread. In more ancient times in Asia there was another stone even more wonderful. This was the Jadah or Yedeh stone of the Turks and related peoples, called Hajar-ul-Mattar by the Arabs and Sang-i-deh by the Persians, and it had the power of causing rain or snow to fall. The actual stones employed probably varied, but some of them, at least, seem to have been the same as true bezoars, that is calculi from the intestines or other parts of animals.

According to some, they were taken from the head of a horse or cow. The Mohammedans say that the first Jadah stone was given by Noah to Japhet but that it was mislaid or lost its efficacy by the wearing off of the name of God engraved on it. The original stone, however, produced others and multiplied by some mysterious sort of generation and its descendants are said to be present in central Asia to this day. The use of the stone is older than this legend, however, and it was well known to the non-Mohammedan Asiatics. Chingis Khan (or "Genghiz Khan") used one in his campaigns, and Tului, his son, was aided by a snow-producing Jadah stone in his invasion of Honan, China, about 1231 A.D.

Probably the most famous incident involving the Jadah stone was the Battle of the Mire in 1365 A.D., between the cohorts of Amir Timur ("Tamerlane") and the army of the Jats (or Jatah) on the bank of the river anciently called the Jaxartes. The following is part of the account of this event written by Mirza Muhammad Haidar, as translated by Denison Ross:

> "For the army of Jatah . . . now that they found their opponents exceeded them in numbers, had recourse to magic, and sought aid from the Jadah stone, which possessed supernatural properties.
>
> "The army of Jatah had not strength for the fight,
> So they sought help from the magic stone . . .
> They filled the world with wind and rain,
> The clouds roared with thunder and the winds howled.
> A thunderbolt fell upon the earth.
>
> ". . . The elements rushed out from the ambush of destiny into the open plain of the ether, and the thunderbolts re-echoed round the azure vault of heaven. . . . It seemed as if the Fates had again become a prey to the love of rebellion and confusion. Such a quantity of water descended from the eyes of the stars, that the Deluge seemed to occur a second time. And the voice of Noah was again heard to pray for the cessation of the waters of heaven.
>
> "The beasts of the field began to swim about in the water like fishes. . . . The feathers of the arrows fell out: the notches came off; while clothes and accoutrements became so heavy with the damp, that neither cavalry nor infantry were able to advance. In consequence of all this, our host lost their confidence and courage. But the army of the enemy [the Jats], remaining where they were, covered themselves over with felt, and as far as they were able, preserved their clothes and arms from the violence of the rain."

Fine weather

Timur, who never was one to put up with opposition even from heaven itself, eventually put an end to this sort of thing. He captured the Jadachi, the magician who made rain with the Jadah stone, and beheaded him. Thereafter the weather was fine.

Babar, descendant of Timur, founder of the Mogul Dynasty of India and, incidentally, cousin of the Muhammad Haidar who wrote the stirring passage just quoted, was a firm believer in the virtues of the Jadah stone. With an honesty that was customary with him, however, he noted that he had never been an eye-witness of its effects.

Not long after the death of Babar, the Russians who were besieging Kazan in 1552 had Jadah trouble. The Tatar queen had her Jadachi bring rain against the Russians, to their great discomfiture. European travelers from Marco Polo to our own times have noted the reputation of various Tatars as rain-makers, but they give few further details of the use of the Jadah stone in this connection.

The American Museum now possesses two bezoar stones that are unique in the whole history of these fascinating objects. If the English had not grown so sophisticated since the days of Elizabeth and James I, we could doubtless barter them for all the crown jewels of England. Or if we only had a thoroughly competent Jadachi, we should be able to produce such rain as the world never saw before and to turn all the deserts into jungles. Ours are not only large, genuine bezoars, of the kind called "Oriental" (although these were found in the United States), but also bezoars from prehistoric animals, one thousands and the other millions of years old—the only fossil bezoar stones known.

Their discovery

One of these was recently found by Fenley Hunter and Albert C. Silberling and presented to the Museum by Mr. Hunter. The collectors supposed that it was an egg, which it strongly resembles, and while our curators refused to class it as that, they could at first offer no other identification, leaving the argument up in the air. By coincidence it happened that at about this time a German paleontologist, Tilly Edinger, published a note saying that although calculi (that is, bezoars) had never been found fossil, they might very well be and that collectors might keep an eye out for them. With this clue, it was recognized that Mr. Hunter's mysterious object was unquestionably a fossil bezoar stone.

This specimen has the shape of an elongate egg, about 1⅞ inches in length and 1¼ inches in diameter in the middle. Originally it was a little larger, as some of the outer layers have peeled off. It is unevenly colored, tan to ivory, and most of the surface has a nearly smooth texture, suggestive of a hen's egg, but the ends have an irregular, warty appearance. It was built up in innumerable layers, like those of an onion but thinner. Broken pieces of these layers look almost exactly like bits of egg shell, but it is at once apparent that they cannot be shell because where the surface is flaked ten different layers can be clearly counted and others extend indefinitely down to the core. This extraordinary fossil was found in Nevada, not far from Las Vegas, in deposits laid down at or shortly after the end of the Great Ice Age (Pleistocene), which means that it is many thousands of years old, perhaps around twenty or twenty-five thousand. It was not in the fossil skeleton of an animal when found; the body must have decomposed, setting it free to be washed away and buried separately. We cannot say surely what sort of animal it came from, but it may well be from a horse or camel. Extinct species of these are common in the strata that yielded the bezoar, and their modern relatives often have similar stones.

When this bezoar was identified, Albert C. Thomson of our staff remembered that he had collected a similar fossil about ten years ago. He had suspected its true nature, but there seemed to be no proof of this and the specimen had been put away with two question marks as a label. Mr. Thomson now brought this out and renewed study shows that it is certainly another fossil bezoar, both larger and older than Mr. Hunter's. Its color is similar to the latter, varying from a dirty tan to nearly white on broken edges. The outer surface is almost smooth and is rounded but flattened, like a slightly irregular and compressed rubber ball about 2⅜ inches in its greatest and 1¾ inches in its least diameter.

Although enough is preserved to show its form and character well, some of the layers were broken and others had been partly dissolved by water seeping through the rock in which it was embedded. It was originally solid, but it had thus come to have an outer shell, made up of several individual layers, through breaks in which a pellet-like central nucleus could be seen, with fragments of the partly dissolved intermediate layers still present between the outer shell and nucleus. The layers vary greatly in thickness, some being as thin as tissue paper and one about 3/16 inch thick. On broken edges each layer is seen to be formed by myriads of tiny crystal fibers, arranged so that all point almost directly outward from the center of the stone.

Mr. Thomson's bezoar was found at Snake Creek, Nebraska, in beds of Pliocene age, probably around ten million years old. This specimen, too, had been washed away from the decayed body of the animal in which it had formed. From its size it must have belonged to one of the larger animals of that time, among which were included extinct rhinoceroses, horses, and camels.

Specimens highly prized

The bottom has fallen out of the once active market for bezoar and Jadah stones and these specimens do not have any outstanding scientific significance, since nothing very definite or new can be learned from them. They are, however, treasured as the most ancient and extraordinary stones of this sort known and for the wealth of tradition and legend that clings to such objects and gives them an enduring and great interest beyond any definite commercial or scientific value. They will remain among the most prized possessions of the Museum.

With these on hand, we are not worried about being poisoned, but we feel a little insecure about the weather. It looks like rain!

OLD ESKIMO ART—*Recently discovered ivory and bone carvings reveal an artistic development superior to that of the modern Eskimos of Alaska and add weight to the theory of an obscure Asiatic origin*

By FROELICH G. RAINEY

University of Alaska

AS VARIOUS peoples throughout the world are known to have in their heritage a great age of artistic achievement, so the Eskimos of Bering Sea now appear as people who once had a Golden Age of art several centuries before they were discovered by European explorers.

Modern Eskimos are still famed as expert ivory carvers, and supply tourists with a wide variety of trinkets cut from walrus tusks; but centuries ago the ancestors of these people, carving either for their own amusement or impelled by spiritual belief in charms, produced a superior and sophisticated art. The simple geometric designs engraved today on ash trays, paper cutters and cribbage boards are now known to be vestiges of the much more complex art which archaeologists have discovered in ancient village sites of the Bering Sea.

On a historic migration route

The modern Eskimos of Alaska have been known since about the middle of the eighteenth century when Vitus Bering discovered the Strait which bears his name, and during the following hundred years their strange mode of life, described by explorers and whalers who plied the Bering Sea waters, attracted great popular interest. But the elaborate art of the ancient Eskimos, representing a period probably many centuries earlier, remained almost entirely unknown until recent years. Then interest in the region of Bering Strait as the probable "bridge" by which primitive man first crossed from Asia to populate the Americas attracted scientific investigators, who with increasing intensity have excavated scores of ancient village sites along the coasts and islands.

The objects illustrated here were excavated on Punuk Island and St. Lawrence Island, less than 200 miles south of Bering Strait. They are not the toys or gadgets which are now made by the Eskimos, but the implements used in everyday life, such as harpoon heads for hunting seal, walrus and whale; knife handles, needle cases, and human figures which may have had religious significance. Though their antiquity has not been established, the blackened condition of the ivory suggests considerable age, and in one site alone, Kukulik on St. Lawrence Island, a recurrent occupation extending over several centuries has been ascertained. Here the accumulated refuse, which has yielded 50,000 specimens, is 20 feet in depth. This site exhibits in succession six clearly defined phases of development as follows: Old Bering Sea, Birnirk, Punuk, Thule, Recent-Prehistoric, and Modern.

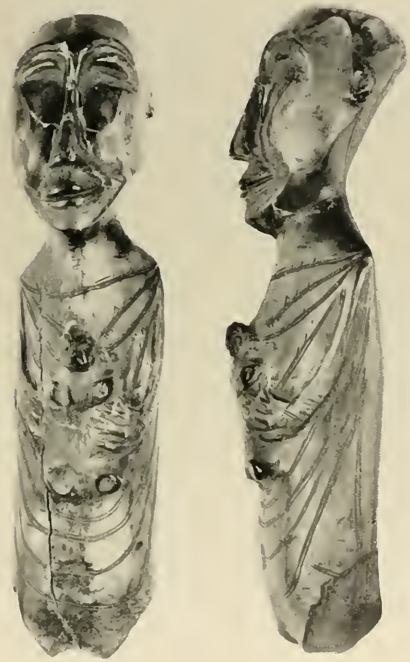
An almost continuous artistic decline seems to have taken place from the time of the Old Bering Sea people, who are the earliest known inhabitants of the region and the most artistic.

The most recent discovery in this area, an old site on Punuk Island, has produced decorated objects scarcely less admirable than the Old Bering Sea material. Examples of this ancient and distinctive art style are chiefly represented in the accompanying illustrations. The great age of the Old Punuk site, though not definitely known, is indicated by the fact that the village itself has been submerged since its occupation by a change in the relative level of the sea, leaving only the adjacent refuse heap for the achaeologist to explore. Furthermore, numerous implements found there are not used by the modern Eskimos.

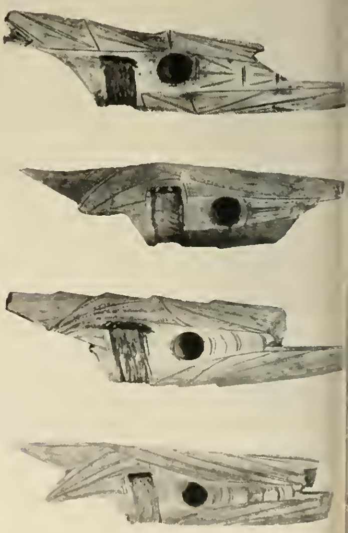
Discovery of Old Punuk

Curiously enough, it was the Eskimos themselves who contributed largely to the discovery of the archaeological treasure on Punuk Island, following a suggestion made by Mr. Otto Geist during a brief visit to the island, when his archaeological eye had been attracted by a patch of unusually green vegetation. Some of the specimens that these natives subsequently brought to Mr. Geist from the site were decorated differently from anything previously known, and in 1934 fired with the prospect of un-

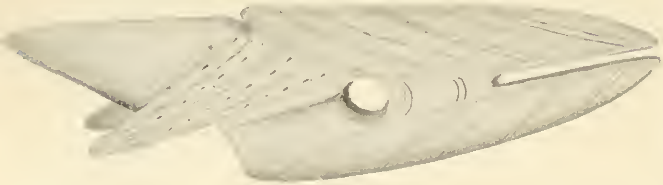
(Right) ESKIMOS AT THE ANCIENT SITE ON PUNUK ISLAND unearthing decorated objects of ivory which prove that their ancestors achieved a higher and more sophisticated artistic culture than themselves. The prominent rock in the background was doubtless used as a landmark in storm and fog by the ancient inhabitants who enjoyed the abundant herds of walrus on this island, 200 miles south of Bering Strait. A change in the shoreline which has submerged the village, leaving only the refuse heap, indicates the age of the site



(Left) THE "PUNUK MADONNA": one of the most artistic carvings yet reported. The child (or possibly animal) held by the "Madonna" is partly broken away, but that the figure is of a woman is indicated by the female sex organ. The long, narrow face and elongated nose, though quite un-Eskimo, are obviously a conscious goal of the ancient Eskimos who carved this type of figure. The features curiously resemble West African wood-carvings and the stone sculptures of Eastern Island, though no connection can be assumed to have existed

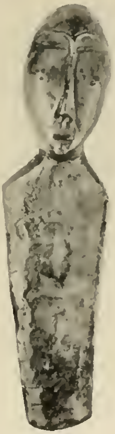


(Right and below) DELICATELY CARVED HARPOON HEADS of the old Punuk culture. Of 176 such heads, all but 16 are decorated with complicated designs similar to these. Material from three later phases of Eskimo art is practically devoid of decoration

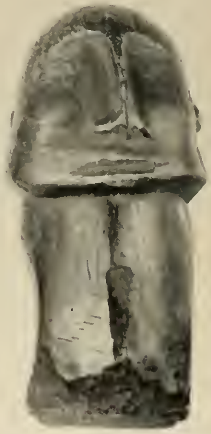


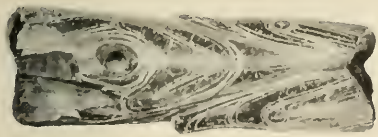
(Left) THE LANDING OF THE UNIVERSITY OF ALASKA DIGGERS, headed by Mr. Otto Geist, on Punuk Island in 1934. St. Lawrence Island (in background) is likewise rich in relics of the ancient Eskimos, and has yielded 50,000 specimens from one deposit 20 feet in depth. The decline of Eskimo art in more recent centuries may have been caused by "hard times" occasioned by scarcity of game and more severe climate

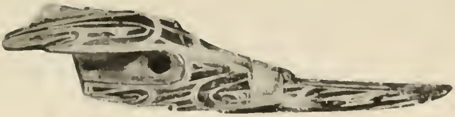
(Right) AN IVORY FETISH DOLL typical of several recently excavated at the ancient village on Punuk Island. All attention is centered in the head of such figures, the body being crudely wrought and the arms and legs almost invariably lacking



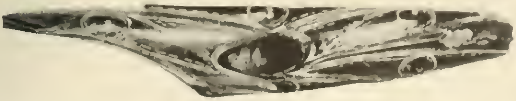
(Right) A UNIQUE FIGURE from the ancient Eskimo culture of Old Punuk. Contrary to the usual mode, the head is peculiarly foreshortened. A very fat person seems to be represented, with huge jowls forced up as if by a collar

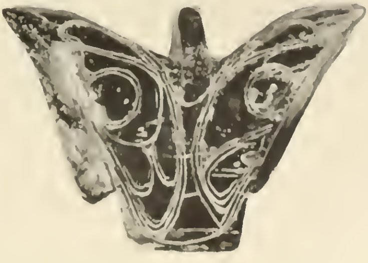


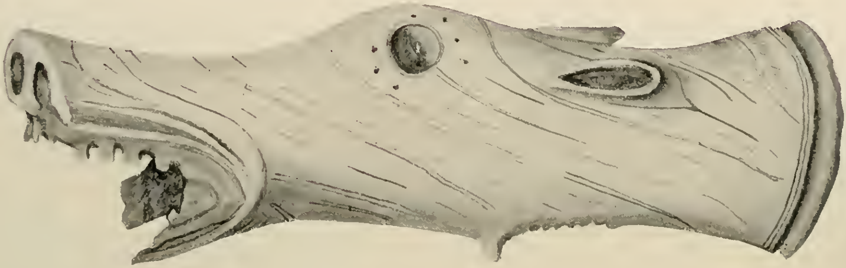




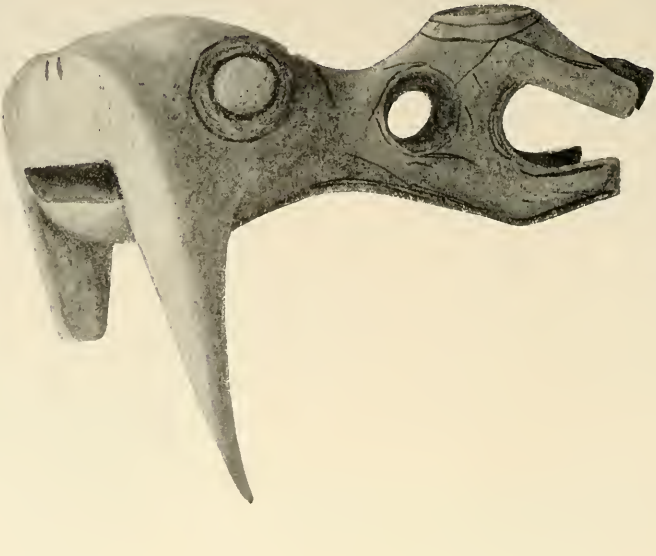
THE MOST HIGHLY DEVELOPED decorative art of the Eskimos is seen in the Old Bering Sea culture, still earlier than the Old Punuk. Elaborate curved lines, swirls, and centered circles are characteristic of the patterns on these walrus-ivory relics, which were made by the earliest known inhabitants of the region and have long since turned brown or black with age







One of the finest animal carvings left by the people of Old Punuk, probably a polar bear. The flattened ears and snarling muzzle strikingly portray an angry animal, and the freely curving lines deftly etched over the surface give motion and life to the figure. It may have been attached to some implement by a slot on the underside



Walrus head: a remarkable example of the primitive use of stone knife and drill. The delicate open-work carving would tax the skill even of modern workers with steel tools; yet the art of the people of Old Punuk surpasses anything produced by the more recent Eskimos earthing a new phase of Eskimo art, Mr. Geist excavated the site for the University of Alaska. Approximately four hundred of the nine hundred ivory objects found there were decorated with the elaborate incised designs characteristic of what is now known as the Old Punuk culture. The people who carved these objects are known to be the ancestors of the modern Eskimos, and that there was an almost continuous decline in Eskimo art down to modern times is indicated by material from other sites more recently occupied in the vicinity.

Leisure time for art

One wonders how the ancient Eskimos happened to develop their sophisticated art, and what caused its decline. We are led to believe that the early arrivals in the region brought with them a highly developed material culture, the result of previous inventive endeavor. On Punuk Island, where the walrus even today congregate seasonally in great numbers, these people presumably found so abundant a food supply that they had the leisure to express their artistic genius in the decoration of even the most ordinary household implements. Perhaps more difficult conditions of life occasioned by scarcity of game or more severe climate forced the Eskimos to neglect their artistic work, or perhaps the decline was simply one of those curious trends that can never be explained.

Though the Old Punuk ivory objects show the brownish discoloration characteristic of all old ivory popularly called "fossil," they are not as dark as the Old Bering Sea material, some of which is almost black. This is not definite proof that the Punuk specimens are more recent, as the conditions of the deposits on the two islands are quite different, but artistically they seem to represent a later development. The Old Punuk specimens were found largely in a deposit of beach sand unfrozen during summer, and this fact probably accounts for the relative scarcity of wooden specimens which are usually common in the frozen refuse deposits of the Bering Sea region.

Most of the implements are unusually well made, symmetrical and carefully finished. The implements as a whole are familiar Eskimo types, embracing a wide variety of hunting and fishing tools and household objects; ivory harpoon heads, the most characteristic weapon of all Eskimos, are the favorite field for ornamentation. The early artists seem to have delighted in cutting strange geometric designs over the surface of their harpoon heads, and of the 176 found, all but sixteen are covered with patterns similar to those illustrated.

Pictorial representation is entirely absent, though some of the designs may be symbolic. It is deduced that the circle and dot motif, as a central figure in many patterns, may represent an eye, for on carved bird's heads and elsewhere it serves this purpose. In some cases small circles appear in the apex of long, converging lines. There seems to be a conscious effort to achieve bilateral symmetry when the form of the object allows, and the designs stream along the objects longitudinally, giving a pleasing and graceful effect.

Though the relative ages of the Old Bering Sea style and the Old Punuk have not been determined, we know that the late Punuk Style discovered by Collins in 1928 is definitely more recent than either. Certain elements of design from this latter, which include "compass-made" circles, have been carried over in the modern art of the Eskimos, and the remarkable regularity of incision may be due to an early acquisition of metal tools, perhaps from Asia.

The Old Bering Sea Style is more graceful, elaborate and sophisticated than either the Old or Late Punuk. One is tempted to assume that its designs are derived from realistic representations long since forgotten and that in the Punuk art all attempt toward realistic interpretation has disappeared, leaving only simplified symbols. In any case, the earliest art that has been discovered in the region does not represent the crude attempts of artists still struggling with an unfamiliar medium, but the work of a people with a long cultural and artistic tradition.

Origins

Early Eskimo art has not been found to relate to the art of any neighboring people. It is different from the fine woodcarving of the Northwest coast Indians and the carving of the Siberian tribes of the Amur River district. It has been compared to Melanesian decorations in the South Pacific and to the Paleolithic art of Cro-Magnon man in Europe, since notable similarities exist, but time and distance argue against any direct affiliation.

More and more evidence points to Northeastern Asia as the origin of Eskimo culture, but the exact place of origin and the antecedents from which the culture developed, remain unknown. The oldest specimens yet found are the finest, and the advantage of metal tools in modern times has not enabled the present-day natives to equal the work of their ancestors who used Stone Age instruments.

THE INDOOR EXPLORER

•

Leaves That Never Fall

PERMANENCY is a quality not readily found in Nature. The truth of this fact is never more evident than at this season of the year when on every side the trees are losing their foliage. Wherever you look you see the leaves fluttering down on suburban lawns to be trampled by footballing urchins. And later, when the sweatered householder has raked them into piles, the air will be pungent with their burning. The rising smoke of the dead leaves is gradually absorbed by the trees and converted once more into living matter. So the endless process of birth and growth, death and rebirth goes on.

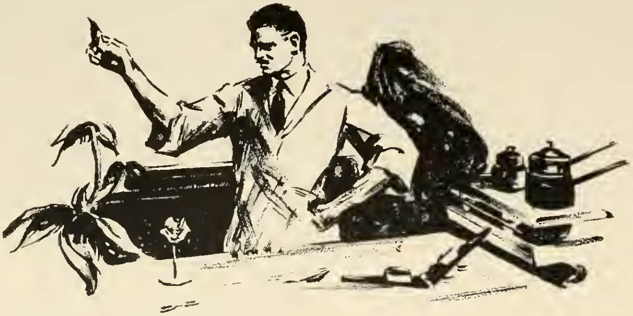
The life of a leaf is short but art is long, and as this Indoor Explorer blazed his solitary trail among the animal habitat groups at the American Museum he was impressed by the timeless quality reflected in the artificial foliage assembled for these exhibition groups. Here were beavers or lions or moose in their natural environments poised among life-like native grasses that never wither, shaded by native leaves that never fall. You see within the Museum authentic replicas of Nature, rescued as if by a mighty candid camera from the oblivion of rotational changes occurring outside its walls. Nature is here arrested and one fleeting moment in her seasonal cycle is made permanent by the skill and labor of the men who build the exhibits.

These men are artists, but in Museum parlance they are called accessory men. Just what they are and how they work were things your Explorer wanted to find out, so he paid a visit to the Department of Arts and Preparations under the directorship of Dr. James L. Clark. There he found Mr. Albert E. Butler, who has been engaged in the craft of making habitat groups from the early years of this century, and who has become one of the foremost men in his field; a master builder of Museum exhibits.

"What schooling do these men have to go through before they can do accessory work?" was the first question.

Mr. Butler smiled. "There isn't any school," he said, "and there is no set of rules by which you can select an accessory man. Of course, a working knowledge of botany is necessary and a feeling for design, but for the most part, we have to break them in and teach them the technique ourselves."

As he talked, Mr. Butler was working on what appeared to be a bud, and in one hand he held a slender metal instrument which he heated periodically over an alcohol flame. With it he scraped bits of wax from a wax block and worked them delicately into a bud-like design which gradually took shape at the end of a wire. Your Explorer asked if most of the leaves were made of wax.



"Not any more," said Mr. Butler. "In the old days, well, as a matter of fact, up till about ten years ago, we made most of the leaves out of wax with a cotton filler, but not any more. We find that we save a good deal of time, effort, and expense by using this—" He held up what looked like an ordinary piece of scrap paper. Then setting down his shaping tool, he took a pair of scissors and in about ten seconds had cut out a perfectly shaped apple leaf.

"Now that didn't take me very long, did it?" he asked.

"No indeed."

"Well, when we made the leaves out of wax, we had to go through the whole business of melting, moulding, shaping, etc., and then we had to put the design on. And as for that—" With a few rapid pencil strokes, Mr. Butler traced in the veins on his paper leaf, then reaching over to the other side of his work table, he selected a brush, deftly dabbed on a bit of green paint, stood up and held the piece of paper about ten feet away under the light from the window.

"See anything wrong with it?" he asked. For a moment your Explorer suspected Mr. Butler of deliberately falsifying some detail on the leaf with the idea of catching him up. He stared hard, but for all he could see, it looked like a perfectly ordinary green apple leaf, and he said so.

"No, there's nothing wrong with it," Mr. Butler reassured. "And this is about the distance from which you'd see the leaf in an exhibition case. Now, when we made the wax leaves, we took more pains with the details as well as a lot more time in making the leaf. This was wasted effort, because in the average exhibit, the leaf is too far away from the eye for the onlooker to get the minor details at all."

"Are all the leaves made of paper nowadays?" your Explorer inquired.

"By no means," was the reply. "We've had great success with non-inflammable celluloid. It holds its shape better when a more intricate type of leaf is under construction, and its transparent quality is particularly useful when we try to give the effect of sun-light shining through the trees."

"And all this leaf-making is done by hand?"

"Most of it. In a few cases where a large number of the same leaf or plant was needed, we had press moulds made and cut them out with steel dies. But in the main we like to vary the plants and leaves used in each individual exhibit, working in the chief types that the particular locality affords."

Was there any possibility of the accessory men becoming bored with a long spell of leaf-making?

My informant doubted that. "It doesn't take very long to make most leaves, as I just showed you. Besides the men vary their work by building rocks out of plaster, snow out of borax or paraffin, and filling in the other materials in the foreground."

Your Explorer wondered if accessory work attracted many applicants.

"A good many," Mr. Butler replied. "You see, the work offers attractions somewhat similar to the Navy."

"How is that?"

It developed that in addition to the fascinating experiments with materials, and the task of building permanent models of Nature "in action," accessory men were given the opportunity to see the world. In order to assure authentic reproduction of the settings in which specimens are taken for mounting by Museum expeditions, accessory men are always part of the personnel. Of course, an accessory man must serve a long apprenticeship in the preparations department of the Museum before he is able to be of service in the field. In response to your Explorer's inquiring why this was so, Mr. Butler said:

"The accessory man must be thoroughly familiar with the laboratory work before we can trust him with the responsibility of selecting the plants, leaves, etc., which we are to reproduce as setting for the proposed group. There are two reasons for this. In the first place, if he has seen a few exhibits built, he has a conception of the general grouping of the materials which would produce the most pleasing effect. But more important than that, he will also appreciate the amount of time and money it takes to reproduce different types of plants. For instance, if I were to send *you* into the field, and tell you to send back specimens typical of the locality in which the expedition was conducted, you could probably gather a fairly representative assortment of material. But, without a thorough knowledge of the methods of reproduction, you would be unable to distinguish between specimens which could be easily and inexpensively manufactured, and those which could be modeled only with great difficulty and at an added expense. An experienced man can often get us material that is ten times easier to reproduce than a complete novice would secure, and just as valuable."

Mr. Butler went on to tell how the accessory men worked in the field. After inspecting the plant life in the region of the camp, they select specimens of each suitable type, together with a variety of extra leaves sufficient to give the range in size and shape.

As soon as they are picked, the plants are preserved in a weak solution of formalin and shipped back to the Museum. Also working on the accessory phase of the expedition are a photographer and a landscape artist. These men decide on a few views which should lend themselves to good reproduction and then make sketches or exposures from which they select what is from every consideration the most desirable scene for the proposed habitat group.

"I don't suppose they attempt to send back anything as bulky as rocks or trees?" your Explorer asked.

"No. Such things are worked up largely from the photographs taken on the spot, but it is not uncommon for a specimen of tree bark or small pieces of rock to be shipped back to us. In the larger habitat groups, the landscape background is often painted on a curved surface at the back of the exhibit. The illusion of reality is then futher enhanced by surrounding the exhibited animals with modeled rocks, foliage and grasses which are situated in the foreground. The painting is completed at the Museum from a series of studies made in the field."

"When grasses are used, what material do you make them out of?" your Explorer wanted to know.

"As a rule, we don't use any."

"You mean you use the grass itself?"

Mr. Butler explained that the grass was preserved with glycerine and formalin and placed inside the exhibition case without attempting artificial duplication. The same applied to mosses and twigs and even in some cases to logs.

"But is there no danger of decomposition or of insect life hatching within the show case?"

"No," said Mr. Butler, "everything is carefully disinfected and preserved before it enters the glass case."

This master builder's description of the care and thought that goes into the creation of a habitat group where every detail shows absolute fidelity to the original natural scene reminded this Explorer of the story, probably apocryphal, which was told of the two visiting Indian Maharajahs and an Indian deer habitat group. It appears that the two orientals were fascinated by this particular exhibit and stood in rapt contemplation of the scene for so long a time that the guard's attention was attracted to them. He decided that the Curator of the department would probably be interested in such prolonged appreciation of his work. Reached by telephone, the Curator hurried down to the Hall and eagerly approached the Maharajahs. Barely able to take their eyes from the scene in front of them, the Indians acknowledged the Curator's self-introduction perfunctorily and turned once more to the exhibit. After the passage of several silent minutes, the Curator interrupted them again with a diffident cough.

"Just what is it that so interests you?" he asked.

The dusky potentates slowly turned around and murmured in awed tones: "Why, this is the view—the very scene—which we look upon every day from our hunting lodge. These are the deer we hunt. Those are the trees that shelter us. And that vista beyond is as familiar to us as our own children."

Whether or not the foregoing anecdote is based on an actual occurrence, it nevertheless serves to indicate the exactitude with which the accessory man constructs the habitat exhibits. And while it is not likely that Solomon in all his wisdom would have to rely on the unerring instinct of the bee to distinguish real flowers from the product of the preparation department, the latter offers all that could reasonably be desired to the eye of even the most exacting Nature observer.

Unlike the practitioners of some other arts, the accessory man does not enjoy the useful heritage of a long tradition. The landscape painter can work in oils or tempera or any of the several techniques developed by the masters. But the artist in the Museum's Preparation Department can only depend upon his own ingenuity for the development of new materials and techniques. The famous Carl Akeley —perhaps the greatest pioneer in the methods of building Museum habitat groups—died little more than a decade ago. It is from Akeley and from the still living Dr. B. Eric Dahlgren of Chicago, that the few trail-blazing devices of this craft have been inherited by the exhibition builders of today. They have made good use of this small heritage, improving the original, discarding the outmoded, adding fresh twists, and even devising methods that are altogether new.

In the year 1890 at the Chicago Museum the first of the modern habitat groups were unveiled. They marked the tangible beginning of Carl Akeley's spectacular career as a Museum builder.

"Yes, and when you consider that they were the first real habitat exhibits," mused Mr. Butler, "they did a truly remarkable job on them. But we've made a lot of advances since then."

"Mostly along cost-cutting lines?" this writer supposed.

"More than that," countered Mr. Butler. "We've done wonders in the line of materials, and we've learned how to cut costs tremendously, but we've also done a great deal to improve the exhibits themselves."

The master builder told how he and his associates had learned to round out the group backgrounds; how they came to paint them on curved surfaces proportional to the total size of the exhibit. Every detail of proportion and perspective was thoroughly investigated and developed. In the larger groups they discovered the desirability of utilizing every inch of perpendicular space, and as their work progressed, they learned to gauge the illusive ratio between widths and depths. Still more important was their development of lighting facilities which enabled them to produce marvelous shadings and color tones. But coincident with this innovation was the problem of servicing the light bulbs and preventing their giving off an amount of heat injurious to the contents of the group.

"How did you get around that one?"

"By housing all the lighting equipment in a compartment separate from and above the exhibition case," answered Mr. Butler. "The light beams are usually directed diagonally into the group from the separate compartment, which has the advantage not only of giving light without heat, but permits the electrician to make repairs and replacements without having to enter the exhibition group at all."

Despite all these latter-day improvements, Mr. Butler has the greatest respect for the early work in his field. "Take those old Akeley exhibits," he said, "you can go out to Chicago and see them right now and you'll find them every bit as good as they ever were."

Your Explorer wondered if these early Akeley exhibits had wax foliage. On being informed that they had, he inquired whether wax was as durable as the modern paper leaves. The reply was that wax was an unpredictable medium.

"The Heath Hen Group which I built in 1906 and the Ground Squirrel Group of 1914 were both constructed of wax as far as their plant accessories were concerned," said Mr. Butler. "And although they have stood in the Museum since that time, they are still in as good condition as the day they were first shown to the public. On the other hand we have had wax foliage deteriorate in a year's time. There doesn't seem to be any explanation. We can make two exhibits in identically the same way and yet one will last and the other won't."

Mr. Butler added that even Dr. Dahlgren of Chicago, under whom he studied, and whom he considers the greatest wax worker in this country, had not been able to find the cause for this variability in wax.

"What is the earliest habitat group still on exhibition in the Museum?" queried your Explorer.

The first background group, it turned out, was the Cobb's Island group. This was built in 1901 and was followed by San Joaquin Valley Bird group, the Flamingo group and the Sand Hill Crane exhibit, which were completed in 1904, 1905, and 1906 respectively. Mr. Butler worked on all of them.

As to how long they would continue to last, Mr. Butler could only guess. One thing he was sure of, however, was that all these early exhibits had paid for themselves in the long service they had rendered. The new groups with paper or celluloid leaves would probably outlast the animal specimens they sheltered. The latter are treated to prevent moths from ruining their fur, but on the whole they are more perishable than their surroundings.

To the question of how the exhibits were kept clean, Mr. Butler responded that some of the smaller ones required less cleaning than you'd suspect and that their glass cases were fairly dust proof. But the larger, illuminated groups, such as those in Akeley Hall, present a different problem. There appears to be an atmospheric pressure caused by the difference in temperature inside and outside of the case, which if left unrelieved, will cause the background to crack. This pressure is removed by what is called a "breathing tube." It consists of a pipe which is filled with a clotting of slightly oiled cotton or steel wool. This serves to filter most of the dust from the air which enters the case and obviates the necessity of cleaning these larger groups except after very long intervals. It is interesting that air conditioning apparatus of this sort was used to protect mounted animals before people used it for their own comfort.

It is in the making of these larger groups, incidentally, that the accessory men occasionally resort to mass production methods. In the African Gorilla Group for instance, it was planned to use a vast number of celery plants, requiring fifty thousand individual leaflets in all.

"You can easily see," said Mr. Butler, "how long that would have taken us by hand, even when we were using paper or celluloid. With wax it would have been almost an impossible task."

In filling this extensive order, the Preparation Department drew the patterns for each type and size of leaf. Then cutting and pressing dies were made. The cutting dies turned out the leaves twelve at a time all trimmed and ready to shape and wire. Details of the leaf form were then added by the pressing dies, and the leaves were ready to be assembled in the exhibit.

Your Explorer felt that he had learned just about as much of the accessory man's way of life as he could assimilate in one sitting. So, he arose, thanked his host, and departed for another tour of the halls below where he spent a couple of fruitless hours trying to tell paper leaves from wax leaves. He found this a little beyond his optical powers. He was sure of one thing, though. They were built to last and, barring earthquakes, or an air raid, he'd never live to see them fall. —D. R. BARTON.

RECENTLY ELECTED MEMBERS

THE following 109 persons have been elected to membership in the American Museum of Natural History since the last issue of NATURAL HISTORY:

Sustaining Member

Mr. Leonard Tarcher.

Annual Members

Mother Superior Agnes M. Barry.

Miss Eva G. Rickert.

Doctor Herman Theaman.

Messrs. Victor J. Hammer, Percy H. Jennings, J. R. Judson, Bertram Nicholson, William J. Pape.

Associate Members

Mesdames H. E. Corey, Anita De Lazier, Jane R. Eaton, Percy B. Flanders, Paul Gorham, Agnes McClain Howard, Wm. M. Lawton, George Medders, Ada Shear Meiselman, A. E. Norman, C. E. Powell, J. Seligman, Ella O. Shoemaker, J. H. Smith.

Misses Mary E. Adams, Elizabeth G. Althouse, Minnie M. Appleton, Lucretia F. Battles, Barbara Ann Henry, Marie B. Isleib, Elsie R. Lyons, Mary Alice Page, Mary L. Stanberry, Winifred Thompson, Grace E. Tower.

Commander Paulus P. Powell.

Doctors A. E. Cruthirds, Phil P. B. de Rautenfeld, Emmanuel Dias, Harold M. Fisher, Elsie Fox, Edward B. Jordan, Israel M. Landau, A. Metraux, Lucille J. Nathans, Charles Niles, A. W. Sweet.

Professors Frances Y. Michel, Burton L. Rockwood.

Messrs. Frank H. Ahl, M. J. Anderson, W. G. Banks, Allen F. Bates, Henry H. Beitler, George G. Block, A. Bovretzen, Herbert V. Carman, Jr., Arthur S. Chenoweth, Emil A. Ciallella, Harold V. Collard, B. W. Conrad, Charles Dettborn, J. Doorschodt, Joseph A. Duner, Herman A. Eggler, John Edward Farley, John Forst, Donald Foster, Marshall S. Foster, Richard H. Foster, Leigh French, Adam Edward Gamon, Jr., Antonio Goubaud, Daniel M. Higgins, Thos. G. Horesco, Nathan Horwitz, Edwin Wallace Ives, Wilbur L. King, Fred J. Kohlruss, Robert C. Kunz, Gustave Ernst Lehner, Archibald H. Lewis, Frank A. Love, Clarence E. Massey, Sam McDowell, Jr., Robert H. Moulton, V. L. Mullenax, Charles Twigg Myers, Joseph Nocera, Louis Nyiri, Charles Popper, Charlton Price, P. H. Reagan, Jock Robey, Harold Rosenzweig, Edgar I. Rowland, James Scanlan, Frank Schmitt, Jr., Herman C. Siebert, Robert B. Sipe, William Soukup, R. R. Squire, M. B. Streeter, Ralph Telcher, George Theiss, A. W. Thompson, Harry Tucker, Myles A. Walsh, Ralph Watson, Elbert A. Wickes.

YOUR NEW BOOKS—*Jungle Boy—Mainly About Wolves—Mathematics for the Million—Foundations of Geography—Bird Photography—Field and Garden Flowers*

MANGA, AN AMAZON JUNGLE INDIAN

by Richard C. Gill

Frederick A. Stokes, $2.00

HEAD HUNTING is certainly the one occupation of the Indians living near the headwaters of the Amazon that has been given world-wide notoriety. But that it is neither very prevalent among them nor by any means their most interesting activity is a conclusion no reader of Mr. Gill's very commendable narrative can escape.

Manga is an Indian youth coming of age in the jungle. And his story comprises the most sympathetic treatment of a primitive mind that has come to this writer's attention since La Farge's *Laughing Boy*. It does not attain the artistic dimensions of the latter work; but as a spirited and on the whole reliable portrayal of Indian life in the upper Amazon region, it is unsurpassed.

Frankly an adventure story, *Manga* is fast-paced, ablaze with jaguar hunts, poisoned arrows, hair-breadth escapes, and one singularly well-handled description of native warfare. And yet Mr. Gill finds time for valuable and highly informative accounts of the more sedentary jungle folk-ways. There is the organization of tribe and family; the fetishes, the customs, the ritual—and pervading the entire book, a true feeling for the extremely precarious existence of primitives versus their environment. Best of all, though, is the chapter on Manga's first visit to Iquitos, the great village of the *Franzi* (white man). When a writer attempts to give the impressions made on the naive savage mind by its initial contact with white culture, he usually yields to one of two temptations. Either he tries for cheap laughs or he becomes slobberingly sentimental. Mr. Gill does neither. He knows his Indians and Manga's dignity is preserved throughout.

If there is a fault in the book you will find it, I think, where the author contrives to put in the mouths of Indians certain commentary material that properly should be told in his own words. When Manga says to the American explorer Jimmy Parker, (to Manga, "Zheemi"):

"So, my Zheemi, now you see all that we own—not only these weapons but everything which you see about you—has been made by our own hands. Look you, friend. From the occasional *franzi* traders who visit us we get very little. A few knives, axes, and machetes, some nails and fish-hooks, a little powder and lead for the white man's gun of my father, some rolls of cloth—that is all. Why should we need the implements of the white man when we have in our hands all the materials of the jungle for making our own implements for preserving us from our enemies, for bringing us food and shelter? What more could we need?"

It is a little difficult for me to imagine an illiterate Indian voicing so glib an appraisal of his people. But this subtle flaw will doubtless be imperceptible to the younger audience for which the book is primarily intended. For such, it is a palatable lesson in anthropology. And it deserves every encouragement, coming as it does in an era where so much poisonous razzledazzle is unblushingly broadcast, filmed and printed to the irreparable softening of the adolescent brain. We need more antidotes like it.

D. R. B.

FAMILIAR FLOWERS OF FIELD AND GARDEN

by F. Schuyler Mathews

D. Appleton-Century Co., $2.50

THE announcement of the revised edition of *Familiar Flowers of Field and Garden*, out of print for many years, will come as welcome news, particularly to those who have long regarded Dr. Mathews' *Field Book of American Wild Flowers*, his *Familiar Trees and Their Haunts*, and his other books as ever trusted field companions.

The some two hundred excellent drawings by the author should be valuable aids to identification of common plants, both wild and cultivated, when found during the flowering season. Dr. Mathews' comments on the history, native homes, and habitats of plants, as well as his personal observations, should be valuable as teaching aids, for they are written in his ever accurate and delightful manner.

Instead of grouping the plants according to the color of their flowers, as is the case in the *Field Book*, they are here arranged in calendar form in the sequence of blooming time. The plants that have a long blossoming period are listed in the month when they start flowering, with a heading at the top of the page covering the entire period, as for instance:

"Bouncing Bet, *Soponaria officinalis*, July to October"

A valuable addition to the book is "The Systematic Index of Familiar Flowers of Field and Garden." This gives nomenclature preferred by the International Congress of Botanists as of 1905, family relationships, geographical distribution, environment, color of flower, and time of blooming for each plant included in the descriptive portion of the book, plus over two hundred others that are not described. This includes a really large amount of data in a usable and compact form.

In my opinion this book will be a worth while addition to the library of students or of teachers of natural history when teaching from the layman's angle. Those who are interested chiefly in the familiar flowering plants of our gardens or in the "common flower that growest beside the way" will find in this book much unusual information told in a particularly readable fashion.

FARIDA A. WILEY.

GREAT HISTORIC ANIMALS. MAINLY ABOUT WOLVES

by Ernest Thompson Seton

ERNEST THOMPSON SETON has again shown his ability to combine natural history with romance in the latest collection of short stories from his pen. Old histories, fireside tales of trappers and hunters, and observations of his own serve Mr. Seton as material for nineteen tales. These are apparently independent and yet with a common thread running throughout: the relationship and community of nature between man and the wild animals.

There is, in my opinion, a weakness in the stories of Mr. Seton in that his animal characters are overhumanized. For while it seems that man differs from the other mammals quantitatively rather than qualitatively, the difference in degree is considerable, and Mr. Seton occasionally tells of happenings that seem to belong to folklore rather than to natural history without indicating plainly whether or not he actually accepts them as true. Many of the stories are thus combinations of careful observation and poetic imagination, and it is questionable if the reader can always decide which are the facts.

The stories vary greatly in subject-matter but most of the book concerns wolves, and these are perhaps the most interestingly written. In places the wolf tales have a saga-like quality; fittingly, for the northern pirates commonly compared themselves to wolves in ferocity and courage.

Today it is hard for us to realize the fear inspired by wolves as late as the 18th century. Now they have been exterminated everywhere except in the northern wastes, but in Mr. Seton's stories of La Bête and Courtaud, the old days when they were abundant are made very real.

Several accounts of wild habits that persist in domestic mammals, some short stories about rodents, a tale about a dangerous adventure with a bull, and four dog stories are included. There is a romance or parable, the Leopard Lover, retold from Balzac, and the book ends with a triad of stories, two exalting the character of man's primate relatives and one describing the depths of brutality to which man can sink.

JOHN ERIC HILL.

A GUIDE TO THE SNAKES OF NEW JERSEY

by Harold Trapido

The Newark Museum, $.50

FOR more than a hundred years naturalists have had an intelligent interest in the snakes of New Jersey. In fact, it might be said that a large number of America's finest herpetologists received much of their early field experience in that state. In the course of time then, it is not surprising that considerable information has been gleaned, and some of it has been summarized in this little book.

With the avowed intention of providing help to the uninitiated, the Newark Museum and the author, Mr. Trapido, have done a commendable job in publishing this popular guide to New Jersey snakes. Excellent photographs of each of the twenty-one serpents known to occur in the state, along with a simplified key and a description of each snake, should enable one to identify any snake found there. The full range of each species is stated along with brief notes on the habits and habitat, and three pages provide a condensed résumé of modern information on the rattlesnake and copperhead.

Of several similar state pamphlets recently published, this is one of the more accurate. But it is unfortunate that one of the more enlightening discoveries in recent reptile investigations has been overlooked. For the facial pits of rattlesnakes and their allies are no longer believed to be auditory, as stated. Early last spring the results of extensive investigations carried on in the laboratories of the Department of Experimental Biology of the American Museum of Natural History were published, and in this paper Noble and Schmidt demonstrated that these pits function as extremely sensitive heat receptors which enable their possessors to detect warm-blooded prey by sensing their body temperature at a distance.

Mr. Trapido's style is a little terse with an overabundance of simple sentences for a popular account, but he has given carefully the most recent scientific names for each species, and to this has added common names. However, the name "leather snake" for one of the water serpents does not seem to be especially suitable. Donors of popular names for snakes have not achieved the asinine sentimentality of what I suspect were lady botanists who named plants "tidy tips" and "baby's breath" but there still seems to be nothing gained by perpetuating such names as "spotted adder," or even "milk snake," when these appellations are neither descriptive, appropriate nor even picturesque.

A selected bibliography would have been an asset to the guide book, for it is hoped that many New Jersey residents will be interested in learning something more about snakes. Nevertheless, this little publication fulfills a recognized need, and if it enables all residents of the state to distinguish harmless and beneficial snakes from the two venomous ones it will have accomplished what one hundred years of preceding work has failed to do.

C. M. BOGERT.

THE FOUNDATIONS OF GEOGRAPHY

by Richard E. Dodge and Stanley D. Dodge

1937. Doubleday, Doran and Company, $3.75

I AM pleased with this new book. It has been prepared by two well-known educators, who have been teaching geography in colleges for many years. Their wide knowledge and experience has led them to present one of the oldest of the sciences in a new way. As stated on the jacket cover, the book is a concise, but complete introduction to the study of geography—both physical and human. The text has been prepared as an introductory course for colleges. Its main purpose is to show not only the inter-relations between the physical and human factors, but to give the student a thorough knowledge of the fundamental principles and background of geography so that he may have the foundations for interpreting the geography of his own and other regions.

The subject matter is organized so that the student may proceed, not only from the simple to the complex, but from general principles to specific adaptations. The aids at the ends of each chapter called "Generalizations and Working Principles" are designed to help the student in study and review. The numerous photographs, maps, graphs and diagrams also assist greatly in vitalizing the subject.

CHESTER A. REEDS.

THE KHĀRIĀS

- - - - - - - - - - by Sarat Chandra Roy and Ramesh Chandra Roy

"Man in India" Office, Ranchi, 1937. Rupees Eleven

BY the record of his twelve years' study of the Khāriā tribe Mr. Roy, assisted by his son, has added an important chapter to the as yet largely unwritten book of Indian physical anthropology and ethnology.

The Khāriās have their stronghold in the hill country of the eastern portion of the Central Provinces and in Orissa, India. The authors find that the tribe falls naturally into three sections, according to economic development. These divisions represent three successive levels of primitive culture and thus furnish fruitful material for a comparative study and clear comprehension of the earlier stages in the evolution of human culture. "Here," says Dr. Marrett in his stimulating Foreword, "are all the makings of an intensive study of human ecology within a single and manageable area."

Early history, physical anthropology, material culture, social and political organization, customs, religion and folklore are taken up in these two volumes, which total 602 pages and are well illustrated.

Mr. Roy has brought to his undertaking a particularly happy blending of talents. Not only a finely trained anthropologist, but a native of the country which he is studying, he has approached his task with a deep and sympathetic insight which has enabled him to translate the underlying meaning of much that would be incomprehensible to the outsider or would entirely escape record.

THIRTY YEARS OF NATURE PHOTOGRAPHY

- - - - - - - - - - - - - - - by Seton Gordon

Cassell & Company Ltd., London, 21s. net

HERE is the inside story of bird photography told by an untiring worker in the field of feathery portraits. Besides being one of Britain's foremost naturalists, the author proves himself to be an outstanding portrayer of the common as well as the shy birds of England. The text is illustrated with 108 photographs made by the naturalist and his wife during three decades of stalking and picturing the wild life of their native land.

The interesting connection between the photographs and how they were taken is the most valuable as well as the most entertaining feature of the book. The stories of how the birds were discovered, patiently stalked, allowed to become accustomed to the hidden photographer, and finally photographed after the most tedious waiting, vividly illustrate the difficulties and time-consuming nature of this work.

Some of the details of the methods of photographing such nervous subjects as birds are interesting in the extreme. The various types of blinds in which the photographer sits with his camera are described in such a way that they become part of the story rather than a working instruction. The use of a bottle protruding from the blind to accustom the birds to the sight of a lens and the observation that birds cannot count up to two are some of the brighter sidelights occurring in the accounts of this naturalist's adventures.

Outside of the Red Deer and the Grey Seal, the book is devoted to the photography of birds. Actually, the book is not so much a working manual of nature photography as it is an interesting series of stories and pictures of bird personalities that the author has encountered in his long associations with his tiny, air-minded friends.

CHARLES H. COLES.

MATHEMATICS FOR THE MILLION

- - - - - - - - - - - - - - - by Lancelot Hogben

W. W. Norton, New York, 1937, $3.75

EVERYONE likes a good story. Perhaps that is one of the reasons why *Mathematics for the Million* has achieved so unexpected a success, for this is a weighty book about a subject most people avoid. Unlike Durant who "popularized" philosophy by telling the story of the philosophers, Hogben has invested mathematics with an absorbing interest by sticking to mathematics. He never deserts his subject for a "love interest," but he does recreate the social currents which swept mathematics along its course.

From the first steps in mathematics taken by the ancient Egyptians to the highly involved calculus and statistics of the present day, the story of mathematics is integrated with the social needs and aspirations of the millions. When mathematics retired to the arcana of the priests or the specialists it ceased to grow. But repeatedly during the millennia of mathematical history, popular need swept mathematics into the market place and into the world to its enrichment. The Egyptians needed to mark time and to orientate their buildings; they discovered measurement. The Greeks wished to glorify their gods by erecting temples; they developed geometry. The Hindus and the Arabs gave the zero and algebra to mankind, thereby simplifying the clumsy computation of the Greeks and permitting the handling of abstractions with ease. The concept of motion in mathematics is a modern discovery and yielded calculus. Today we are witnessing the rapid growth of the statistics of human populations at a time when the concentration of people and the problems of populations are especially pressing and urgent. This growth has a logical progression that unfolds as one reads this book. The difficulties of mathematics vanish when they are translated in this manner.

The popular response to Professor Hogben's book reveals the latent interest in this field and serves as a tribute to his skill.

H. L. SHAPIRO.

SCIENCE IN THE FIELD AND IN THE LABORATORY

—*Seeking Native Drugs in British Guiana—Expeditions to West and Northwest—Dinosaurs Indoors and Out—the World's End*

Terry-Holden Expedition

Bound for the deep interior of British Guiana, Dr. William Hall Holden, Staff Surgeon of the American Museum of Natural History, led an expedition to study the diseases and drugs of Indian tribes which live along the northern tributaries of the Amazon River. Members of Doctor Holden's expedition will also collect reptiles, amphibians, small mammals and insects for the American Museum as well as botanical specimens for the New York Botanical Gardens.

The expedition, which sailed from New York on August 27, will maintain contact with the outside world through the National Broadcasting Company. The party is equipped to chart its course through a jungle hitherto unstudied by scientists by means of radio equipment provided by the Radio Corporation of America.

After the expedition reaches British Guiana, its progress will be described once or twice weekly, depending on technical conditions, in broadcasts relayed from the jungle through RCA Communications to the networks of the National Broadcasting Company.

With the aid of his radio equipment, Doctor Holden hopes to reach natives who live in the entirely unexplored hinterland on the Brazilian side of the Akarai mountains without running the risk of sharing the fate of explorers who have been lost in South American jungles.

The sector to be explored is the remote, inaccessible and little-known Sierro Akarai range in the southernmost portion of British Guiana along the Brazilian border. No scientific collecting and study of the character to be undertaken by Doctor Holden and his associates has ever been attempted before in this section. Hence, it may be expected that data may be obtained which will throw new light on the dark jungles of equatorial South America.

On his 1936 expedition into the Amazon basin, Dr. Holden came upon the trail of several unusual diseases and unique, but effective, native drugs.

This time, Doctor Holden's quest includes further knowledge about a peculiar form of paralysis which affects the hands and feet of its victims.

According to present plans, the party will be in the field from three to four months. Dr. Holden will lead his expedition 300 miles up the Essequibo River to the mouth of the Rupununi. Thence 150 miles up the Rupununi to Dadanowa, the village of John Melville, the half-English, half-Indian Chief of the Wapisiani Indians. With John Melville as a guide, the expedition will proceed some 65 miles overland to the Kassikityo River, follow it to where it joins the Essequibo and then travel along the latter until they reach the foothills of the Sierra Akarai where headquarters will be established. It is estimated that it will take more than two weeks for the party to reach this objective from the time it leaves Georgetown.

Members of the expedition accompanying Doctor Holden are: Dr. A. C. Smith, Associate Curator at the N. Y. Botanical Gardens, botanist; Mr. Robert Snediger of the Department of Herpetology, American Museum, herpetologist; Mr. William G. Hassler, cinematographer; Mr. Neil MacMillan, field assistant, and Mr. Orison Hungerford, radio engineer of the National Broadcasting Company.

Grand Canyon Expedition

Dr. Harold E. Anthony, Curator of Mammals of the American Museum is the leader of the Patterson Grand Canyon Expedition which is exploring the tops of Shiva Temple and Wotan's Throne. These erosion-made "islands" high up in that geological wonder of wonders, the Grand Canyon, are believed to offer to the natural scientist an extraordinary opportunity to study animal species which, isolated from the mainland for several thousand years, have been untouched by the evolutionary changes going on in the surrounding country. The sheer cliffs leading to Shiva Temple present a problem in mountain-clmbing which was only recently solved by the Expedition. (See page 558.)

Ornithological Adventure Ends

Dr. James P. Chapin's "wild peacock chase" in the heart of Africa has been successful. The strange, peacock-like bird that he discovered stuffed in a European museum he has now rediscovered in its natural haunts in the forests of the upper Congo. He has seen the bird in life, heard its voice, learned much concerning its habits and secured several specimens. Dr. Chapin is expected to reach the museum by October first bringing with him the details of this romance of modern ornithology.

Dust Bowl Studied

The study of soil erosion has carried Dr. Chester A. Reeds of the Geology Department on a journey of 9,000 miles through 21 states of the Union this summer. After attending the convention of the American Association for the Advancement of Science held in Denver, June 21-26, Dr. Reeds visited the "Dust Bowl" area in the Southwest, then traveled southward via Dallas and Vicksburg, eastward through the southern Appalachian Mountains and the Piedmont belt, and back to the Museum on August 2nd.

Meteorites Transferred

A collection of Meteorites which represents about 63 years of effort on the part of the Geology Department has been catalogued by Dr. Reeds and was published by the Museum in July as Bulletin, Vol. LXXIII, Art. VI, pp 517-672. This catalogue constitutes a record of the specimens that were transferred from the Department of Geology to the Department of Astronomy as of October 1, 1935. Some 548 Falls, consisting of 3,744 specimens are recorded.

Museum Goes on the Air

Members of the staff of the American Museum of Natural History and other scientists in the field of exploration and natural history science, will be heard in a series of broadcasts to be given Monday evenings at 6:15 p.m. Eastern Standard Time during October, November and December over the Columbia Network. These presentations will be entitled "New Horizons" and will be brought to the microphone by the C. B. S. Department of Talks as part of the Ten Year Development Project of the American Museum and of which A. Perry Osborn is executive chairman.

The premier of this series, which will take those who listen-in from pole to pole, across deserts, into jungles, over mountains and the seven seas, takes place on the evening of October 4th when Mr. Osborn will introduce Vilhjamar Stefansson, noted arctic explorer and President of the Explorers Club. Dr. Stefansson will discuss the theme "Trans-Arctic Aviation," with particular emphasis on the polar flights and studies undertaken by Russia this year.

On October 11th, Dr. Walter Granger, Curator of Fossil Mammals of the American Museum, will draw a word picture of the biggest land mammal known to science, namely, the Baluchitherium which lived in Asia 25,000,000 years ago. This beast was taller than a giraffe, twice as long as two elephants and weighed about 60,000 pounds.

The October 18th presentation deals with "Ancient Man in Asia." In this broadcast, Dr. Roy Chapman Andrews, famed Asiatic explorer, will discuss the Dune-Dwellers of Mongolia, with possible reference to the current situation in the Orient and its effect upon further scientific expeditions in Mongolia.

Gorillas will be the topic on October 25th by Dr. Harry C. Raven of the American Museum. He will recount his experiences in studying the habits of gorillas in the thickly wooded mountain sections of the Congo, where these much maligned creatures make their home.

Other noted explorers who will be heard on this program in the course of the series include Dr. Barnum Brown, who is now hunting Dinosaurs in Wyoming; Dr. Harold E. Anthony, leader of the Museum expedition which is exploring Shiva Temple and Wotan's Throne, two of the Sky Islands in the Grand Canyon of Arizona; Dr. James L. Clark, who has followed the trail of the hunters from Alaska to Africa; Dr. Robert Cushman Murphy, one of the world's foremost students of marine bird-life—just to mention a few of the explorers who have helped in the making of "New Horizons" and whose first-hand stories about their work will be told on this program.

End of the World

Despite the fact that all evidence today tells us that the earth has been spinning upon its axis at the same rate and traveling around the sun at the same pace, undisturbed for over one billion years, people still speculate on the end of the world. So the Planetarium in October will take its visitors forward thousands of years in the future, where they may have grandstand seats for that improbable time when a comet might strike the earth, the sun grow cold and dark, a new star blaze forth in the sky nearby, or the moon come crashing into our planet. It will be an exciting adventure far in the future. After each proposed catastrophe the audience will be miraculously restored to the same old planet, with the sun rising on a day 26,000 years in the future, and everything as we usually find it.

Summer Gifts

Among the numerous outstanding gifts to the Museum of specimens during the summer were exceedingly valuable donations of butterflies and moths from Messrs. Frank Johnson and E. L. Bell; of bees from Professors T. D. A. Cockerell, P. H. Timberlake and Mr. H. F. Schwarz; of termites from Professor Alfred E. Emerson and Dr. Wolfgang von Hagen; of flies from Professor C. L. Fluke and Mr. Colbran J. Wainwright; and of beetles, including approximately 150 species and varieties new to our collection, from Mr. David Rockefeller.

Insect Course

During the autumn and early winter Curator Frank E. Lutz will give a course of late afternoon lectures at Columbia University. The course will be open to anyone who has had satisfactory training in elementary biology and will deal with nearly all aspects of insect life.

Honors and Awards

A four months tour of the European museums at Paris, London, Berlin, Leiden and elsewhere was the proposed itinerary of Dr. John Eric Hill, American Museum Mammalogist who sailed on September 7 aboard the S.S. *Statendam*. Financed by a Carnegie travel award, Doctor Hill plans a thorough investigation of the African mammal types lodged in the various museums. The familiarity with known African specimens thus gained will aid him greatly in his formidable task of cataloguing the large and ever-increasing collection of mammals from the dark continent accumulated by the American Museum.

• • •

The work in marine invertebrate zoology and allied subjects carried on by government and other scientific institutions in the Phillipines and Dutch East Indies is to be investigated by Dr. Willard G. Van Name of the Museum Department of Living Invertebrates. For six months Dr. Van Name will study the localities and opportunities for collecting in this territory, and will, if possible, bring back information useful to future expeditions of the Museum and new specimens for the invertebrate collections from that region. His trip is made possible by the Carnegie Corporation through one of its Travel Grants for Museums of Science and Art.

Model Swazi Village

The Department of Anthropology has recently been the recipient from Mrs. Bryce W. Turner of New York of an unusual gift. It is a replica in miniature of a native Swazi village and was especially made for Mrs. Carl Akeley by African natives in the district near Mbabane on her recent expedition in Swaziland.

In the construction of these replicas only material native to Swaziland were used—branches of trees, reeds and grass. Nothing of white man's invention was employed.

Dinosaurs Indoors and Out

Dr. Barnum Brown, who is in charge of the American Museum-Sinclair Expedition in the dinosaur field of Rock Springs, Wyoming, writes from camp that his party has been highly successful. At least one complete dinosaur skeleton and large parts of several others have been secured. These represent the horned dinosaur, the duck-bills, and the carnivorous types. They came from the Mesa Verde Cretaceous formation and apparently represent distinctly new species and new genera.

* * *

Mr. Albert Thomson has been exploring again the rich fossil field of the so-called "Big Badlands" of South Dakota. These Oligocene strata constitute what is probably the richest Tertiary mammal deposit in the world. The American Museum began collecting there in 1892 and has had parties there at various times since then. In fact nearly every museum in this country has, at some time or other, sent an expedition into this most prolific fossil field. Recent reports from Mr. Thomson indicate that while surface fossils are much rarer than formerly it is still possible to make worth-while collections there, and this even in spite of the fact that motor highways now allow tourists to enter the field at various places and to pick up every surface fragment in sight—thus destroying important "leads" for the scientific collector. The paleontologist is inclined to paraphrase the slogan of the wild flower lovers and say "Save the fossils."

* * *

There has recently been placed on temporary exhibition in the Dinosaur Hall a nearly complete skeleton of the most fantastic of the horned dinosaurs. Its name is *Styracosaurus* and it is characterized by having long bony spikes on the edge of the great frill of the skull which extends backward over the neck in all of the ceratopsians. This specimen was much flattened laterally by crushing and has been prepared as a double slab mount, showing both sides.

The Snyder Mountain Expedition

The vast unexplored region lying west of the Mackenzie River from the 60th parallel to the Peel River is a sort of no man's land from a biological standpoint. Practically no scientific research work has been carried on between the Mackenzie and Yukon drainage.

Mr. George G. Goodwin, American Museum representative and mammal collector, returns to the Museum bringing back a representative series of mammals from this unexplored region, and 5000 feet of motion picture film. He reports having visited vast unrecorded ice fields extending many miles across towering mountain peaks and a range of mountains that are being named in honor of Mr. Harry Snyder, who financed and led the expedition.

The expedition left Edmonton on June 5, traveling north by plane to the Slave River and then by power boat to Resolution, across Great Slave Lake, down the Mackenzie to Fort Simpson, and up the Liard and eventually the white waters of the Nahanni to Virginia Falls, which are actually 300 feet high, then by plane to Glacier Lake where base camp was established. From here the expedition visited surrounding mountains and penetrated 60 miles west over the border into Yukon territory to an apparently unknown lake which drains into the Pelly.

Mountain Goat Expedition

The collection of material for a mountain goat exhibit in the new North American Hall is the purpose of the Clark-Kissel Alaskan Expedition, now somewhere in the southeastern quarter of that peninsula. Gardell D. Christensen and Joseph M. Guerry of the Museum Preparation Department have accompanied the expedition to supervise the preservation of specimens and sketch background material for use in the habitat group.* Part of this background will be one of the famous Alaskan glaciers—probably Taku.

Schedule for Museum Lectures

For Members:
Alternate Thursday evenings

October 21—*Natural color motion pictures of flowers of California and Hawaii*—Mr. Arthur C. Pillsbury.

November 4—*Motion pictures and recordings of birds and bird songs*—Dr. Arthur A. Allen of Cornell University.

November 18—*Hayden Planetarium-Grace Peruvian Eclipse Expedition*—Major Albert W. Stevens, photographer, and Dr. Clyde Fisher, leader of the Expedition.

December 2—*"Colorful Courtships of the Animal World"* —Dr. G. Kingsley Noble, illustrated by motion pictures in color.

December 16—*"Jungles Calling"*—by Mrs. Osa Johnson.

For Children:
Saturday morning

October 23—*"Woodland Symphony"*—by Mr. Ellsworth Jaeger.

November 6—*Description of Peruvian trip and eclipse*—by Miss Dorothy Bennett of the Planetarium.

November 20—*"The Indian in Song and Story"*—by Te Ata.

December 4—*"Our Animal Friends and Foes"*—by Raymond L. Ditmars.

December 18—*"Hunting Giants of the Sea"—a motion picture on whaling*—by Chester Scott Howland.

ASTRONOMY SERIES

Evening classes—Monday to Friday—beginning October 4, continuing until second week in May—Amateur Astronomers Assn.

KNOW YOUR MUSEUM SERIES

Alternate Tuesday evenings, beginning October 26—by Dr. William K. Gregory on "Evolution, the Master Key."

GEM SERIES

Saturday afternoons at 4 o'clock, beginning October 9—by Mr. Herbert P. Whitlock.

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*See Indoor Explorer of this issue on work of Preparations Department.

ember **NATURAL HISTORY** *1937*

ent Art of Beautification · Tree-Climbing Fish

ve Thanksgiving · Rock Paintings & Clyde Fisher

Bread, Butter, and Jam for 13,000,000 People

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FREDERICK TRUBEE DAVISON, President ROY CHAPMAN ANDREWS, Sc.d., Director

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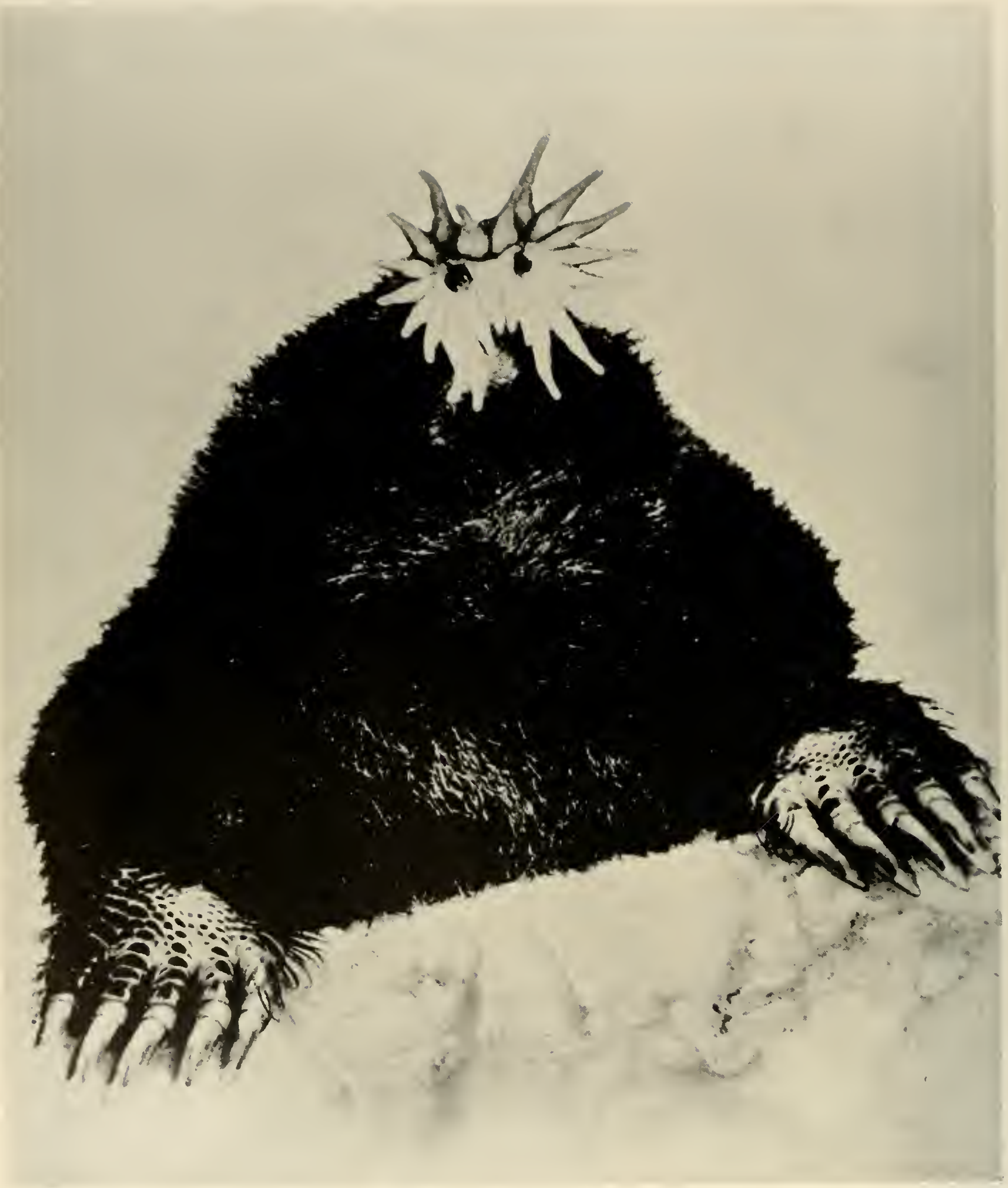

STAR NOSED MOLE

A native of eastern North America, the star nosed mole has a ring of ribbon-like appendages around its muzzle, the nostrils being situated in the middle. The exact function of this ornament is not known, but it is thought that it is a sensitive organ of touch which helps the mole discover the whereabouts of the worms and insects on which it feeds and which it encounters during its underground wanderings

THE INDIAN AND THE WHITE MAN'S BUFFALO—

Pathetically clinging to his old ways, the Indian hunted the tame cattle that were given him, but his race withered under a system of Government handouts

By CLARK WISSLER
Curator of Anthropology,
American Museum of Natural History

The old wife of a celebrated Indian chief to whom the writer was once introduced many years ago, shook her fist and said—"You belong to the wicked race that took away our buffalo." The conversation had turned to the question of rations and the beef issue. She cast aside the dignity and poise befitting her position, and spoke with a sharp tongue: "Sickness is now on every hand. Children are dying. Strong men are going to their graves before their time. All this happens because of the bad food the white man gives us."

Her speech might have been more moving had she not rolled up her sleeve to show us her "emaciated arm." Some days earlier we had watched her chopping wood with a white man's axe, giving it the full swing from the shoulder seen only in a professional. So we addressed her as "Grandmother" and tried to convey the idea that even on white man's food she was a better wood-chopper than most white men. She was pleased with this flattery, but bared her arm once more and declared that it was a sorry sight compared with what it was when she had all the buffalo meat she could eat. With that, she picked up her dirty sack and set off to get her share of the detested beef, now ready for issue.

Food problem

From the time when the Indians of the Old West were first segregated on reservations the food problem was always one of the most troublesome for the Government Agents. It was their job not only to keep some semblance of order among a war-like, dispossessed population, but to provide food for a nation of red men who for centuries had made their living by hunting and who had built up around the chase a set of traditions so deeply engrained that they had become almost instinctive.

A system of allotted rations was developed which grew directly out of the various compensative treaties by which the white man sought to placate the Indian for the robbery of his more prolific hunting lands.

Early Indian administrators

The Kings of England and France, recognizing the reality of the several tiny Indian nations, sent messages of good will to them, as one King to another. Though the procedure might sometimes be a farce, there was a serious side to it, in that these Christian rulers eased their consciences by admitting that the Indian had right of possession, which was not to be denied without compensation. So a treaty would be drawn up in which the Great Mothers or the Great Fathers, as the case might be, promised that if the Indian would keep his feet off certain lands and his hands off the white-man's scalp, he might enjoy certain other clearly defined lands upon which to hunt forever, free from white intrusion. Finally, the Indian was to receive the value of certain sums of money in specified goods. That in general was the pattern followed by the early American Indian administrators.

From a reputed eye-witness we heard the story of

Clark Wissler is probably the only man in the world today who could have written the article above. His unusual knowledge of a little-known phase of the "only yesterday" of the Great West is derived from his experiences as one of the first field anthropologists among the Indians.

These reminiscences form the second of a series of articles appearing in NATURAL HISTORY, which it is hoped in the interests of personalized history will be numerous.

Aside from his position as Dean of the Scientific Staff of the American Museum, Doctor Wissler is Professor of Anthropology in Yale University, and is considered one of the leading American anthropologists.

To the copious list of books and papers he has written, the present series adds a new note of intimacy and creates almost the only detailed, authentic picture of an American scene which has found romantic expression in fictional literature and on the motion picture screen.

one such issue of treaty goods. There was a quantity of stale army biscuit and wormy salt pork; this they rejected at sight; anyway buffalo were still near at hand. There were coffee and rice. The latter they had never seen; the former was rarely urged upon them by the traders. Some of the Indian women took the green coffee beans, put them into a kettle and boiled and boiled; each time they tasted the mess it was worse than before. So, at last, they abandoned the coffee in disgust.

There were several hundred rolls of calico. They knew what this was, but the trader had sold them only a few yards in a piece. Never had they come into possession of such an unending fabric. A few mischievous youngsters found it was funny to jerk at the loose ends, watching the cloth unroll, especially when one ran with it. Many rolls were unwound in this way. Finally, one inventive fellow tied the loose end to the tail of a horse, gave the animal a kick in the ribs, whence, seeing the strange shape in his rear, the horse stampeded. This was the beginning, and soon several hundred frightened Indian ponies were dashing here and there on the plains with long, gaily colored streamers behind. All the camp, young and old, screamed themselves hoarse at this ludicrous sight.

Consider the experience of the Blackfoot Indians who were to receive $35,000 in goods each year. One of the early consignments contained a few thousand fish hooks. Perhaps that does not move you, but this tribe would not eat fish, the mention of it being enough to turn their stomachs. They felt about it just as you would if asked to eat caterpillars. What could these people do with all those fish hooks!

"Scraps of paper"

It was in such bargains by treaty that the pattern was set for the subsequent ration and annuity systems. The unfortunate feature of the procedure was that all these treaties, like many others, were "scraps of paper." Before the Indian had time to adjust himself to one contract, another would be made, curtailing his hunting lands or removing him to new locations until at last, hemmed in by white homesteaders and cattle ranches, he was cooped up on reservations and forced to stay at home. It was the monotony of staying at home that broke the hearts of those natural gypsies.

The great reservations were between the Mississippi and the Rocky Mountains, the land of the cowboy and the Indian of Wild West fame. For the most part, these Indians ate buffalo meat and little else. Even our doctors now admit that one can live in health on a diet of meat alone if all parts of the animal are consumed. But the coming of the reservations was coincident with the passing of the buffalo, and of buffalo hunting.

The popular notion of our day seemed to be that Indians lived on dog flesh. Some tribes did eat puppies on special occasions but other tribes held such food in abhorrence. Merely to take note of the gangs of adult and aged dogs slinking around an Indian camp might refute the idea that they were important food animals. So although some Indian tribes could not sympathize with the white man's aversion to dog, many of them would agree that the very idea of such food was nauseating; they would starve rather than eat one. And if the Plains Indian loved his dog, he adored his horse. So it is not strange that he never ate horse except in cases of dire need. Even in our time the mention of horse meat never met with approval.

Live cattle for the Indians

When the Government undertook to feed these Indians, they first offered them army rations, hard tack and salt pork, but the stomachs of these fresh meat lovers revolted at such a mess. Illness and gloom stalked through the camps. Then live cattle were brought for the beef issue, and with them one of the most picturesque features of old reservation life was inaugurated.

At regular intervals cowboys with chaps, high-heeled boots and oversized spurs, eased bunches of steers toward the reservation, where after being duly inspected and counted, they were to be held by night-riders for issue on the following day. The reader who has never camped near such a night-herd has missed something that defies description. The writer experienced something like it once at a small Agency which lay at the end of a long stage coach trip. There was no hotel and, arriving after dark, the trader offered me a bunk in the attic of the store. The next morning I was awakened by the buzzing of the flies, and in the increasing light saw in the other end of the attic many hanging coyote and wolf skins, still green, as the trappers say. This was a somewhat disquieting sight and I shifted my bed roll to a pile of lumber outside, which was too high to be reached by horse, steer or dog. One morning, shortly after, I was awakened in the gray dawn by a deep grumbling, roaring sound, the bawling of cattle. Presently the herd came into view, in close formation. It was a mass of horns in moving shapes, the largest herd I ever saw. Two cowboys were riding ahead as decoys; impressive, tall, graceful figures, such as one could see anywhere in the cow country. On the flanks outriders herded all stragglers back into line. It was soon evident that my lumber pile was directly in the line of march and would be engulfed. Imagine yourself standing on a small platform, looking into the faces of the front line of steers advancing without hesitation as if to overwhelm you, and then being surrounded on all sides by a moving mass of cattle, your feet on a level with their backs, but knee-deep in horns. The view in the rear was less inspiring because of the lazy stragglers and an unpicturesque cook-wagon accompanying the roundup; but even these soon vanished over the adjoining swell, leaving the Agency to its usual routine.

Again, a cattle train was unloaded near an Agency where I was staying. The animals were held in close formation through the night, and their grumbling bellowing was continuous though rising and falling in rhythmical waves with every now and then a rushing roar as one hears on a beach during a windy day. For hours I lay in my camp bed marvelling at this unusual, weird sound, and visualizing the vague shapes of the night-riders keeping their cattle within bounds, prepared at any moment to cope with a stampede.

"Mongrel buffalo"

These cattle were to be taken over by the Indians, a few here, a few there, in an effort to set them up in the beef business, according to the theory that, though still wards of the Government, they should be self-supporting. It seems strange, at this distance, why the Government did not recognize the deep-set, spontaneous interest of the Indian in horses and set him to raising them. There probably was a complex of reasons. For one, the horse stood for the old life and so was to be frowned upon. Again, as noted, most Indians had an aversion to horse meat and since the whites did not eat horses either, scarcely could they be expected to encourage the Indians to raise them for food. On the other hand, the Indians were urged to raise cattle. In this, there was but moderate success. Somehow or other, even the western white man rarely warmed up to a cow as a pet and between him and the male of the bovine species, perpetual enmity was in evidence. This being the situation, we should not be too hard upon the Indian. To him cattle were but mongrel buffalo—white man's buffalo he often called them, and there were no traditions of domestic friendship between his ancestors and the buffalo. Anyway, the buffalo took care of himself, why not the ox? Of course, what was in the back of the white man's head was milk, butter and cheese. He took for granted that any person in his right mind would like milk. But the Indian revolted at the idea.

Nor does the Indian stand alone. The Chinese, surrounded for ages by milk-using peoples, refused to taste the stuff, saying that only savages and moral perverts would rob the calf of its proper food. Again in the cattle country surrounding the Indian, white sentiment was not what would be expected. For long, Montana was distinguished as the state exporting the most cattle and importing the most milk products. In those days one could start a shooting match by asking a cowboy if he ever milked.

One of the incidents of Reservation days I treasure most happened when a roundup took place near our Agency. One of the cowboys was brought in desperately ill. The Agency doctor looked him over, then turned to the patient's companions and remarked that about the only thing to pull him through would be fresh milk. The cowboys looked sheepishly from one to another and asked where it was to be had. The rejoinder was, "Milk a cow."

"Won't canned milk do?" they asked.

"No," said the doctor, "he will die if you can't get him fresh milk."

The cowboys withdrew into a huddle and discussed, with emphasis on the latter syllable. Finally, they rode out toward the corral, rounded up a cow with a calf, and drove her into the enclosure. Of course, by this time she was in a fighting mood, but was roped in good cowboy style, thrown and tied. One cowboy took a tin cup, squatted beside the cow and seized a teat. Now, if you recall your first attempt at milking, you understand. You may know, also, that a cow must be in a friendly mood, otherwise, as the farmers say, "she will not let her milk down." Anyhow, after long labor and much profanity, about a spoonful of milk was in the cup. Then another cowboy took a turn, but with no better luck. Once around they accumulated three or four spoonfuls; then all stood up and swore most emphatically that not another drop would they milk, Jim could just die if he was so stubborn as all that. The terrified cow was released and with a snort or two, tail in air, "streaked for the blue."

Meat, not milk

We never saw Indians milk, but have heard that some of them did after they learned how in a school. Yet, when an Indian saw a steer or a cow his mouth began to water, his stomach was as completely conditioned in its reflexes as Pavlov's famous laboratory dog. But it was not because he recognized milk, butter and cheese; what he saw was a wealth of fresh meat. Even a few years ago we heard of an illustration. A sick baby being in need of milk, the doctor urged that a cow be bought. As of old the many relatives of the family rallied manfully to the call for help. Enough money was soon raised for a cow and a few Indian families set out for the outside farming country, where a purchase was made. But on the way back they were met by a messenger telling them the baby had died. So they made camp, conferred for a while, then butchered the poor cow and stayed on the spot until the last scrap was eaten. No wonder the most pessimistic people we ever knew were veteran employees in the Indian Service.

The old timers in the Indian Service could tell how cattle were issued in their day and it was as exciting as a buffalo hunt.

Wild hunters and tame cattle

A large corral was built, a kind of primitive stock yard, from which the issue was made. There was a chute reminding one of the mechanism for loading steers into freight cars, but with the difference that the steer was shot out into the open instead of into a traffic prison. Above the chute rose a little house not unlike that of the switch tender in a railroad yard. This was the post of the issue clerk and the keeper of the ration roll. The clerk would call out a name and if an Indian responded and was identified, the one or more steers due his family group were driven into a little pen at the entrance to the chute. Then when all was ready the clerk made a mark in his book and shouted, "Release!" The gate to the chute swung wide and the panicky steers rushed into the open, where lay in wait a brigade of boys and men clutching repeating rifles and mounted on impatient ponies. True to fashion some were stripped to breech cloth and moccasins and smeared with war paint. The steers seeking freedom were greeted with a war-whoop and, more frightened than ever, tails in air, bolted toward the horizon. At their heels rode a yelling band of redskins. For several generations the Indians had ridden hard after buffalo and it was their fixed belief that meat was no good unless the animal had run miles at top speed. A range steer could run, he was built for the work, and when cornered he could fight, but the odds were all against him here, for when the leader of his pursuers thought his blood properly heated, the shooting began, and that was the end.

In due course came the butchering, the first job being to skin the animal. In the offing the women were waiting with pack-horses; they soon arrived, for by tradition the meat belonged to them, so, of course, they must do most of the butchering and above all, carry the meat home. In the old days the man shot the animal down, refreshed himself by eating some of the liver or a kidney, then came home and told his women where they would find the carcass. And before you pass harsh judgment on the Indian's failure to do the heavy work, remember that the inexorable law of his people said that it was her meat.

Even an ultra modern abattoir is a poor place to go for exercising aesthetic impulses and if one yearns to know what our forefathers gazed upon in an Indian massacre, he should see butchering in the old way, faces, hands, and bodies smeared with red.

We are now looking in upon a time when a horse, war paint, and a rifle so revived the ancient patterns of Indian life that no white man was altogether safe. It was an easy step from the blood of a steer to something more serious, and we must not forget the repressed desires of the early reservation Indian for fresh scalps, for horse-stealing, for heroic deeds. So when the Indian let himself go at the beef issue, there was no knowing where he would rein-up again. Many old time employees admitted how they dreaded the beef issue.

Many stories were current about a certain hardheaded agent; even the Indians had traditions recounting his virtues and exploits. Once when he was in a tight place, surrounded by threatening Indians, demanding impossible things and threatening to seize the Government's property and make away with the whites, he calmly called their attention to the vast potential magic power of the whites and to bring it home to them, read appropriate passages from the Bible, how the Lord of Hosts would smite those who opposed His will, etc., until the fear of the white man's God gripped their souls. Certainly here was a hero in the Indian Service, nor will you be surprised to learn that the agent in question was a fighting Scotchman of the old school.

"Open season" on cattle

Of course, one way to have shown the Indian a good time would have been to turn the whole herd loose. Something like this happened occasionally, as once in Dakota when a violent thunderstorm at night stampeded the herd. It broke away toward the Black Hills in fan-shaped formation so that all the cowboys could do was to round up a handful. But the Indians went on a grand hunt—and why not? The cattle were to be theirs in the end. It was a gala time for the hunters. All the old buffalo technique could be used in scouting for the game and organizing the attack. And then, plenty of fresh meat. It is true that many times the wrong cattle were killed, for the hunters followed the slogan, "Shoot first, ask questions afterward." A lot of trouble was made for Government officials, but the Indians experienced a temporary psychological rejuvenation.

The white man killed his beef in what he called the civilized way, and even the most indifferent agents were shocked over such savage customs as butchering in the open. At last one of them wrote to Washington—

"Beef is still slaughtered for issue in the same barbarous and wasteful way as practiced in the days of Abraham, and at the seige of Troy—shot, skinned and dressed on the open prairie in the rudest way. . . . This whole business should be reformed as speedily as may be. Slaughterhouses should be built, with proper water supply. Indians should be taught, and then hired to do the butchering in an economical, cleanly way; and last, but not least, the beef should be weighed out on the scales, so that the weak and unprotected should be as certain of their lawful allowance as the strong."

The last statement strikes us as funny, for Indians always share their food. To weigh it out would be about as useless as to insist upon filling a pond by pouring an equal amount of water upon each square yard.

Well, when even the agents began to talk against the beef issue, change was in the offing. Anyhow, on the reservation everything was so transient that the Indian was in perpetual bewilderment, for no sooner had he adjusted his economy to one code than another was substituted. And so it was with the spectacular beef issue. The efficiency experts at Washington were scornful of such ways of butchering, shocked at spreading the carcass upon a fresh clean bed of prairie grass. And so an order went forth (most every mail brought the agent new orders) directing that a slaughterhouse be erected. Of course, upon the heels of the order arrived a man recommended by his Congressman and duly appointed a butcher, as his credentials showed. Probably he had never killed a steer nor even seen it done, but what were the odds! The meat was for Indians. Anyway, a few Indians would be employed to do the real work, the butcher's job being to fill out some blanks and pay-check orders.

Disease

So it was that the Great Father demanded that the Indian quit killing cattle and that the major issue to them, over the butcher's block, clean, lean, meat. No doubt the reader is ready to applaud, but there was and is a joker in it all. Tuberculosis became rampant, children began to show all kinds of tooth trouble, etc., causing those in charge of reservations to send urgent calls for doctors and medicines to try to undo what was being done in the name of decency. Of course, we are still doing such things, shutting daylight from our bodies and at the same time paying high prices for medicines to compensate for the deficiency, insisting upon devitalizing foods but keeping the chemist and the druggist busy preparing vitamin compounds.

We visited some of these "reformed" butchering places, equipped with the improved sanitary methods. We found it best to hold our noses as we approached and shut our eyes to avoid seeing poor miserable old women quarreling over the parts rejected by the butchers, because Nature had taught them these were essential to health. This new way may have been efficient, but its sanitary aspects were nothing to brag about.

Under this new regime the ration tickets called for so many pounds of lean beef, ready for the pot; certain days were posted for beef issues, requiring the Indians to make long journeys in wagons or with pack horses.

Foot-loose people

In aboriginal times all Indians seem to have enjoyed gypsying around and the ration system offered a good substitute in the journeys to and from the agency. On many large reservations, each family claimed a log cabin, but was seldom found living there. They would set out a week or more before ration day to congregate in large camps around the agency. This was much more interesting than staying at home. After the beef was secured the surplus was dried, and this could best be done in camps here and there over the reserve. Some agents did not like this, as—

"The Indians [U. S. Indian Report, 1892, p. 454.] were accustomed once a month to take all their children and such belongings as they were able to take and move into the agency to receive their rations. They always started in time so that they could visit along the road coming in and were an equal length of time getting back to their homes. The results entailed were: Neglect of field and stock and the taking of the children from the schools; also, endangering of the health and lives of those who were at all weak physically. At an issue some time in January last, during the severe winter weather, a child was frozen to death on the mother's back. This, of course, is an extreme case, but the system entails great physical suffering on the part of the women, children, and the old and decrepit."

We do not take these remarks seriously for these Indians did like to go somewhere; moving camp was their joy. We never could understand why Indian agents objected to the Indians having a good time.

Perhaps the answer is, that the white man got his rations by the sweat of his brow, the Indian by going on a picnic.

The theory back of rations was the same as behind relief in time of great depressions in white society: all rations were to be temporary, to ease off gradually, and thus put pressure upon the Indians to become self-supporting. There was often a hue and cry in polite society to do away with this so-called degrading charity, this creator of shirkers and dependents, until at last these reformers had their way. Rations were ordered abolished; starvation was looked upon as an effectual goad to force the Indians to super-human efforts. Like all rules from Washington, these new orders were abrupt.

Starvation

Rations stopped. Naturally it was a shock. The old and the sick could not work, so as a compromise a select list was made and rations issued to them. All this accomplished was to divide the individual rations into tiny feeds. Indians have always been liberal with food; not to divide with everyone in sight is unthinkable. So there should have been no surprise as to the outcome of limiting rations to the old people. Each of them lived with somebody and that somebody and all his many relations came in for a share. The result was tragic, for now everyone was hungry. Thus the starvation process of civilizing the Indian was put to work, but about all that came of it was greater poverty, malnutrition and gloom. Possibly among those directing our Indian policies were some hard realists who secretly hoped the Indian problem would be solved by death and disease, but if so, they were doomed to disappointment. For centuries the Indian had been hardened by adversity. He could go without food and drink an amazingly long time. On the other hand, when food was at hand there seemed no limit to his capacity. Perhaps this was his adjustment to the situation. Anyhow, the Indian did not starve to death and though his death rate rose, his birth rate remained high, if we can trust the statistics available. History tells us that temporary food shortages have always confronted mankind, and students of population tell us that, strange as it may sound, a depression seems to step up the birth rate whereas prosperity inhibits it. If this proves to be true, we suspect the long survival of the human race is due to such a compensating relation. Anyhow, everyone around the old reservations knew what an Indian could do with food.

Once, when traveling in the Indian country, we stopped for our lunch, since nightfall should find us at the agency. Before our little fire was mature enough for cooking we spied an Indian coming our way. One of our guides once said an Indian could smell grub ten miles away and often it seemed there must be more truth than fiction in the saying. Anyhow, there were no Indians in sight when we made camp. He was an old man, with gray hair and a crooked leg which he assisted with a long staff, yet the speed with which he arrived was astonishing.

Soon he was seated near the fire and as we lunched we passed food to him, but the real exhibition of his technique came later. There remained a large package of crackers, about ½ pound of butter, a few slices of cheese, a bottle of pickles, a large can of salmon, two cans of tomatoes and a moderate amount of other left-overs. When we set this before him he hitched up his blanket and prepared for action. First he asked that all the cans be opened. This done, he fell to. Every now and then he would pause and attempt to say something which sounded like, "wash-tay." He being a Sioux, this probably meant "fine, good, etc." Though he had previously eaten as much as we, he consumed everything put before him, and as we rode away, we saw our guest industriously licking the tins that nothing be wasted. No doubt his diet had been most meager for days, but now luck having come his way, he could stand another fast. He was especially fortunate in that no other Indian sniffed our smoke, for then he would have merely shared in a moderate feast.

Conservation of native races

It is not a pleasant subject, this story of the attempts to transform a nomad hunting people into a group of sedentary herders or farmers. But it shows once more how we go blundering about the world trying to improve the manners of other people only to make a mess of it. And the pity of it is that the damage can never be repaired. We cannot help but wish the good old days could come back for the Indian. Even the Office of Indian Affairs so yearns for the past that it has introduced living buffalo to some of the larger reservations, so that they can be rode down in aboriginal style and the old time pemmican can be found in every tent. In imagination the Indian sees joyful meat eaters gathering around the evening campfire, muffled in warm buffalo robes. Yet it is a vain hope, for at best it will be but a counterfeit of the good old times when West was West and Indians were Indians. Popular sentiment is rapidly being won to the cause of Conservation and much laudable progress has been made toward the preservation of the birds and the beasts. But let us not forget that all over the world primitive man is being destroyed. The prevention of this deserves

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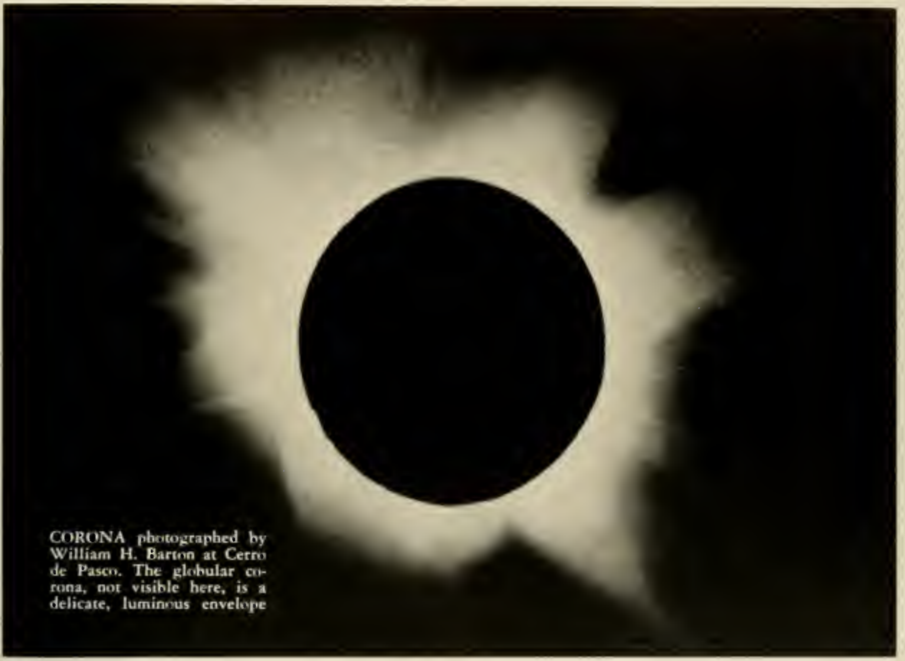

CORONA photographed by William H. Barton at Cerro de Pasco. The globular corona, not visible here, is a delicate, luminous envelope

ECLIPSE IN PERU—*Five separate units comprising an American Museum Expedition secure valuable records of the eclipse in Peru, including new evidence of the globular corona, photographed from the air at 25,000 feet*

By CLYDE FISHER

Curator of Astronomy and the Hayden Planetarium

AT THE RECENT meeting of the American Astronomical Society, held at Williams College, the subject that caused the most lively discussion was the so-called "globular corona", attention to which had been called by Major Albert W. Stevens, well-known stratosphere explorer and aerial photographer. The corona or pearly-white atmosphere which surrounds the sun, extending outward far beyond its red prominences, is the outermost part of the sun's atmosphere. It constitutes the most impressive feature of a total eclipse of the sun, being the one thing that every observer sees, whether scientist or layman. Its total light, although varying greatly, was found at the eclipse of 1925 to be about half that of the full moon.

This newly recognized character of the sun's corona, now referred to as the "globular corona",

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CLYDE FISHER has done more than any one man to bring the Planetarium to America. He is well known to Museum members as Curator of the Hayden Planetarium and lecturer on astronomy both in the Planetarium and on the air. The 1937 Peruvian Eclipse described in his present article is the fourth total eclipse Doctor Fisher has observed, a record made more remarkable by the fact that he had the luck of good weather conditions on each occasion. Few naturalists can boast attainments equaling Doctor Fisher's in scope. Astronomy apart, he is an accomplished botanist and ornithologist, a member of the American Society of Mammalogists, and active in nearly every branch of natural history education. As an astronomer he is noted as an authority on meteor craters. *Exploring the Heavens* is the title of Doctor Fisher's latest book, a popular treatment of astronomy, which was published on Oct. 19.

was noticed by Major Stevens in a series of his photographs made from a plane at an elevation of 25,000 feet, on the Hayden Planetarium-Grace Eclipse Expedition. In the sub-stratosphere, with some two-thirds of the earth's atmosphere beneath him, it was possible to make photographs showing the full extent of the corona in the surprisingly short exposures of 1/20th and 1/30th of a second. On account of the moisture and dust of the lower atmosphere, exposures perhaps fifty times as long would have been necessary on the surface of the earth at sea-level.

The former conception of the sun's corona was that it consisted mainly, if not entirely, of streamers, so close together or continuous at their base as to form an envelope one-third of a solar diameter or so in depth. The streamers themselves extend outward a distance once or twice to several times the diameter of the sun.

The photographs made by Major Stevens, however, indicate that besides the streamers there is a very delicate luminous, globular envelope, which extends outward from the surface of the sun to a distance of nearly a solar diameter. This is the so-called globular corona.

It is obvious that much preparation in the way of organization was necessary, and much travel in order to observe an eclipse several thousand miles from home.

Five observation stations

In order to increase the probability of seeing the eclipse, we planned one thing that had probably not been done before on eclipse expeditions. It takes only a small cloud in the sky to eclipse an eclipse. Therefore, in order not "to have all of our eggs in one basket", we divided our expedition into five groups, to be stationed in rather widely separated places in the path of totality, as shown on the map accompanying this article.

Among other things we planned to photograph the spectacle from a higher elevation than had ever been attempted before, and this was done by Major Stevens.

Through the courtesy and generosity of the Grace Line, the personnel and equipment of our expedition were transported from New York City to Callao, the port for Lima, Peru, and back to New York after the eclipse, on the *Santa* ships, commodious and beautiful vessels especially designed for tropical travel.

Lima, the capital of Peru, was our headquarters, and it was from this city that all of our broadcasts were made, except the one during the eclipse. It was not difficult to staff five separate observation stations since we had thirteen members* in the field. Dr. John A. Miller, our Technical Director, was unable to go to Peru. It was generally felt that Major Stevens would have the greatest probability of clear skies, since he was to fly in a Pan-American-Grace plane having a possible ceiling of 30,500 feet. Taking off at Lima in the Panagra Airliner with Captain Charles Disher, Pilot, Mr. W. E. Gray, Copilot, and Mr. W. O. Runcie as assistant photographer, Major Stevens flew over the middle of the path of totality, that is, approximately over Chimbote on the coast of Peru north of Lima.

Points of interest

Beyond the Panama Canal we paused for a few hours at Buenaventura, Colombia, where we saw many natives in dug-out canoes; and at Guayaquil, Ecuador, where we met "islands" of water-hyacinths floating down the Guayas. At Trujillo, which can be reached from the port of Salaverry, we visited Chan Chan, the famous pre-Inca ruin of the Chimu culture, which covers about ten square miles. On the return voyage, among other points we stopped at Manta, Ecuador, the center of the famous Panama hat industry. The trip requires twelve days each way, and on this occasion it was twenty-four days of smooth seas and fair weather, punctuated with a day or so of gentle rain and just a bit of fog, perhaps to help us appreciate more fully the almost continuous gorgeous weather.

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*The personnel of the Hayden Planetarium-Grace Peruvian Eclipse Expedition was as follows:

Dr. John A. Miller, Director Emeritus of the Sproul Observatory, Technical Director.

Dr. Clyde Fisher, Curator of Astronomy in the American Museum and Head of the Hayden Planetarium, Leader.

Mr. William H. Barton, Associate Curator of the Hayden Planetarium, Executive Officer.

Dr. Serge A. Korff of the Carnegie Institution, Associate Astronomer.

Mrs. Isabel M. Lewis, Computer of Eclipses at the U. S. Naval Observatory, Associate Astronomer.

Miss Dorothy A. Bennett, Assistant Curator of the Hayden Planetarium, Observer.

Major Albert W. Stevens of the U. S. Army Air Corps, Aerial Photographer.

Mr. Dana K. Bailey of the Steward Observatory, Associate Astronomer.

Mr. D. Owen Stephens of Moylan, Pennsylvania, Artist.

Mr. Charles H. Coles, Head of Photographic Department of the American Museum, Official Photographer.

Mr. Hans Christian Adamson, Chairman of Public Relations, American Museum, Director of Publicity.

Mr. William Perry of Columbia Broadcasting System, Announcer.

Mr. Raymond W. Newby of Columbia Broadcasting System, Radio Engineer.

Miss Sally Pyle, Secretary.

The following persons accompanied the expedition, assisting in various capacities: Mrs. Hans Christian Adamson; Mrs. William H. Barton; Mrs. Raymond W. Newby and daughter, Nancy Lee; Mrs. Serge A. Korff; and Te Ata (Mrs. Clyde Fisher). Miss Agnes Denn Johnson of Lima accompanied the Huanchaco group as Artist.

Since Peru is almost directly south of New York City, we did not change our Standard Time belt. Our latitude, however, was greatly changed by the journey, for it took us more than 10 degrees south of the Equator. For all the members of our expedition, this was the first journey into southern latitudes, one enthusiastic member stating that he appreciated his trans-equatorial certificate from King Neptune more than his college diploma.

Under southern skies

For all of us the trip afforded our first real view of the southern skies—our first view of the celebrated Southern Cross and the coal-sack near-by; our first sight of Alpha Centauri, the nearest star we can see without a telescope, Omega Centauri, the brightest globular star-cluster in the whole sky, the Magellanic Clouds, Gould's belt, etc.

The Curator of the Planetarium feels that, for the members of the Expedition who lecture in the Planetarium, the opportunity to study the real southern sky and to become familiar with the beautiful and interesting heavenly bodies of that region, was more important and valuable even than the observation of the eclipse.

Of our four land parties the southernmost and highest was stationed at Cerro de Pasco, at an elevation of nearly 15,000 feet in the Andes, near the southern edge of the path of totality and northeast of Lima. Mr. William H. Barton, Executive Officer of the expedition, was in charge of this group. With him were Miss Dorothy Bennett, delegated to make visual observations, a valuable project not usually provided for on eclipse expeditions; Mr. D. Owen Stephens, Artist, and Mr. Charles H. Coles, Photographer.

The second unit was composed of Dr. Serge A. Korff and Mr. Dana K. Bailey and was stationed a little way inland from Moro, Peru, almost in the middle of the path of totality.

A short distance south of the middle of the path, near Pira, Peru, was our broadcasting unit in charge of Mr. Hans Christian Adamson. With him were Mr. William Perry, Announcer, and Mr. Raymond W. Newby, Radio Engineer, of the Columbia Broadcasting System.

The fourth group, which was our northernmost and westernmost land party, took up its position at Huanchaco, Peru, the first port north of Trujillo. This group was in charge of the writer. With him were Mrs. Isabel M. Lewis, Miss Agnes Denn Johnson, and Te Ata.

Early on the morning of June 3rd, Miss Johnson, Te Ata, and the writer set out from Lima for Trujillo, where we had planned to meet Mrs. Lewis, who was flying down from Washington, D. C. Our journey from the capital of Peru to Trujillo, although only 450 miles in distance, was to take about as much time as Mrs. Lewis's long flight from the north. Our trip lay across the barren desert, our camel being a Ford station-wagon, with three Spanish boys whose duties were divided between driving this ship of the desert and digging it out of the sand.

Striking out northward from Lima, we soon left the good road behind us, and within one hour of our departure were stuck in the sand. Another hour was consumed in digging out and resuming our journey. We soon learned that there was a special skill in driving a motor car over the desert wastes, a rather rapid speed being necessary in order to taverse certain stretches without sinking into the sand.

Desert flora and fauna

At this time of year, the coastal desert of Peru is the most barren that I have ever seen. But there were occasional colonies of spiny cucumbers, the fruit of which is used by the natives as brushes; lemon-yellow prickly poppies, resembling those of the western United States; wild tomatoes with bright yellow flowers, reminding one that both tomatoes and potatoes are natives of Peru; a relative of the pineapple with pale magenta flowers; and spider-flower (*Cleome chilensis*), a close relative of *guaco* used in pottery-making by our Indians of the Southwest. However, for the most part it was utterly barren.

Not only were we attracted by the plants of the desert, but by the animals and birds. One or two graceful foxes crossed our way. Among the birds seen were burrowing owls, turkey vultures, swallows, ground doves, black and red tanagers, large egrets and Peruvian brown pelicans (the largest of the pelicans of the world). Some of these were seen along the short rivers that flow from the Andes across the coastal desert to the Pacific. At the mouth of each river is a town, near which there is usually more or less irrigation for sugar-cane, rice, and other crops. In the Chancay River we saw many traps used in catching crawfish (*camarones*), which constitute a great delicacy among all classes of Peruvians.

An exciting experience of the trip occurred when we suddenly found ourselves coasting down a very steep and high sand dune, with the wheels of the station-wagon set and serving as runners, the incline being so sharp that it seemed to us that our improvised sled might turn somersaults on the way down; but it fortunately did not.

A little way south of Huacho, we passed a large Chimu burial-ground, the ruins of this civilization of the coast of Peru being older than those of the Inca. During the centuries that have passed, the sand has been blown away by the wind, disclosing many skulls and other human bones, together with burial cloth, pottery, etc.—a fascinating place for the archaeologist. Another ancient Chimu burial-ground was passed near the San Nicholas Hacienda between Huacho and Supe.

Dunes

On the second day we passed many of the crescent-shaped sand-dunes, which had been photographed so beautifully from the air a few years ago by the Shippee-Johnson Expedition. They are striking features of the Peruvian desert, and we wished that we knew how these "living" dunes maintain their symmetrical shapes.

Near the end of our trip we drove many miles along the beach just above the breakers of the Pacific as they rolled in. This was exciting after dark for the tide was so high that it was well-nigh impossible to make our way along—to stay out of the salt water on one side and to keep from sinking into the soft sand of the higher beach.

After two long days full of interesting minor adventures we reached Trujillo, a city founded by Pizarro and named for his birth-place in Spain. Here we found that Mrs. Lewis had arrived by plane from the north a day before we came. While Trujillo was to be our headquarters until after the eclipse, our actual eclipse station was Huanchaco on the coast some ten or fifteen miles farther north.

At Huanchaco, we were the guests of the Peruvian Astronomical Commission, Prof. Godofredo Garcia, Chairman, as also was the Japanese Expedition under Prof. Isseo Yamamoto. All three groups, the Peruvian, the Japanese, and the American, were installed in the large dwelling-house of an abandoned hacienda, located on the beach within one hundred yards of the breakers of the Pacific Ocean.

The first contact of the eclipse came at 4:14 P. M., on time, as computed by Mrs. Lewis. The moon always comes from the west in every eclipse of the sun, and in this case, since the sun was low in the west, the moon seemed to come up out of the sea. Since our station at Huanchaco was farther west than any other in Peru, we had the highest sun, 9½ degrees at mid-totality. By the time the sun was half covered by the moon, one could notice the diminution of light, together with the developing of delicate purple colors both in the sky and over the landscape.

After a little more than an hour of watchful waiting, the second contact or beginning of totality occurred—at 5:18 P. M. Coincident with the flashing out of the gorgeous corona, we had one of the finest "diamond-ring" effects that I have ever seen. This "diamond-ring" is produced by the last rays of the sun which shine through some valley or between some irregularities on the surface (edge) of the moon.

Corona and sun-spots

The corona, which is universally regarded as the most beautiful feature of a total eclipse of the sun, was of the maximum-sun-spot type, that is, the streamers of silvery light are about as long at the poles of the sun as they are at the equatorial regions. This was to be expected for the sun was near the maximum-occurrence of sun-spots. In fact, on the day of the eclipse there were three large groups of spots on the sun. The sun-spots occur in cycles of 11 1/3 years, and at a minimum-sun-spot period the corona would be quite different, in that the polar streamers would be very short and the equatorial streamers comparatively long.

At Huanchaco totality lasted two minutes and 33 seconds, at the end of which we again had a wonderful "diamond-ring."

The corona, although indescribably beautiful, was not nearly so bright as that at my last eclipse, the one of June 19, 1936, observed in Kazakhstan, Siberia. One evidence of this is that many stars were seen at the Peruvian eclipse, while none was reported in Siberia. Mr. Bailey, observing at Moro, reported that he saw Sirius, Canopus, the Southern Cross, and stars down to the third magnitude. Mr. Bailey at Moro and Mr. Stephens at Cerro de Pasco reported that they saw Mars near the eastern horizon. Another evidence that the corona of the Peruvian eclipse was not as bright as that of the Siberian eclipse is to be found in my motion pictures of the corona made with the same camera, the same lenses, and the same kind of film, in fact with film of the same emulsion. The corona in the former does not show nearly as great extension. This may be explained partly by the lower altitude of the sun —9½ degrees in Peru and 36.4 degrees in Siberia—causing greater atmospheric absorption in the former.

The elusive and ghostly shadow-bands were seen just before and immediately after totality, but they were by no means as pronounced as they were on the snow at the eclipse of January 24, 1925.

The sun set, still partially eclipsed, sinking into the Pacific Ocean, with the tips of the crescent pointing upward—a unique and impressive spectacle.

This eclipse began at sunrise in the South Seas not far from the Fiji Islands, the path of totality sweeping from there in a great curve across the Pacific Ocean to Peru where it ended in the Andes at sunset. Since the path crossed the International Date Line, the eclipse began on June 9th and ended on June 8th. The length of totality was greatest at the noon-point of the path in the mid-Pacific where it lasted 7 minutes and 4 seconds—the longest total eclipse in 1200 years.

As planned, I made motion pictures of partial phases, the "diamond-ring" effect and the corona, with the Akeley camera, using a 12-inch telephoto lens; and also natural color photographs (Kodachrome) of the corona with the Graflex and Contax cameras, using a 6-inch lens on the latter. Te Ata, with a Bantam Special camera, made Kodachrome photographs of the corona. Mrs. Lewis, using a $2\frac{1}{2}$-inch telescope, photographed the corona with Kodachrome, securing, at an exposure of 1 30th of a second, the best color photographs we have seen of prominences. She also photographed Baily's Beads at the beginning and end of totality. Miss Johnson succeeded in making an excellent painting of the corona, finishing it, of course, after the eclipse.

Cloudless for all observers

On the day after the eclipse, we flew back to Lima where we learned, to our great satisfaction, that all five of our groups had had clear skies. Later we learned that every expedition that set out to observe this eclipse anywhere along the path, had had ideal conditions. Perhaps such amazing luck has not attended observers since eclipses have been studied scientifically.

At Cerro de Pasco, Mr. William H. Barton, assisted by Mrs. Barton, using telescopic cameras mounted on a polar axis, made some of the finest photographs of the corona that we have ever seen. Miss Bennett carried out her program of visual observations in a careful and thorough-going manner, preparing an immediate report illustrated with sketches. Mr. D. Owen Stephens made an excellent record of the eclipse in four paintings in oil, one of the full extent of the corona, one of the "diamond-ring", another of the retreating shadow of the moon, and a fourth of the sun setting partly eclipsed over the snow-capped peaks of the Andes. Mr. Coles carried out very successfully a motion-picture program which included the corona, "diamond-ring" effect, etc., part of which are in color (Kodachrome). The work at this station was greatly aided by the generous courtesy of the Cerro de Pasco Copper Company.

At Moro, Dr. Korff and Mr. Bailey made an excellent series of photographs of the corona in black and white and in color (Kodachrome) with telescopic cameras equatorially mounted. Mrs. Korff acted as timekeeper for the group. Among the photographs are two made on Kodachrome with a Retina camera, which show with great faithfulness not only the full extent of the corona but also the saffron-colored band about the sky just above the horizon. The work at this station was made possible by the generous cooperation of Mr. Leon Rosenshine.

Aerial photographs

Flying over the middle of the path of totality, Major Stevens made motion and still pictures of the corona and of the shadow of the moon. The still photographs of the corona which show evidence of a globular corona were made with a Fairchild Aerial camera fitted with a 24-inch Bausch and Lomb lens. It seems that this theoretical phenomenon which has given rise to much discussion has been photographed before, and even mentioned in the literature, but astronomers had paid little attention to it before Major Stevens pointed it out. An adequate discussion of the evidence would not be possible in this article, but those who are interested will find a fully illustrated article by Major Stevens in an early number of the *Astrophysical Journal*. It now seems probable that it will require at least another total eclipse of the sun to settle the questions that have arisen in connection with this newest contribution to the scientific investigation of eclipses.

Major Stevens' work was made possible by the generosity of the Pan American Airways.

The Junior Astronomy Club made it possible for Mr. Bailey and Mr. Stephens to be members of the expedition. It was a great tragedy that Mr. Stephens lost his life on the homeward trip. Stricken with a thrombosis, he died in the Gorgas Hospital at Ancon, Panama Canal Zone, where we were assured by the surgeons that there was no evidence that his death was due to his activities on the expedition. We are grateful that he finished the work he set out to do, painting six large canvases which are fine examples of his art. No one entered into the work or play of the expedition with greater zest and evident enjoyment.

The spectacle which he and all the rest of us had the opportunity of seeing was observed under ideal conditions; and D. Owen Stephens recorded it permanently on his canvas in all its splendor—the most beautiful phenomenon in Nature.

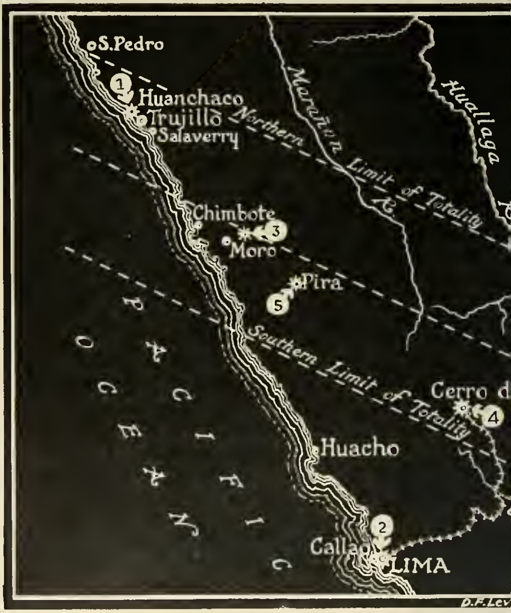
Photo by Te Ata

(Above) Eclipse observers at Huanchaco, Peru: one of the Museum's five stations. Left to right: Professor Isseo Yamamoto, Leader of Japanese Expedition; Professor Godofredo Garcia, Leader of Peruvian Expedition; Mrs. Isabel M. Lewis, of the United States Naval Observatory; and Dr. Clyde Fisher, Leader of American Expedition

Photo by Runciegraphs

(Above) Major Albert W. Stevens, whose flight from Lima along the center of totality yielded photographic evidence at 25,000 feet of a "globular corona"

FIVE-FOLD ECLIPSE EXPEDITION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1
Huanchaco
Trujillo
Salaverry
Marañon R.
Northern Limit of Totality
Huallaga
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Pira
5
Southern Limit of Totality
Cerro d
4
Huacho
2
Callao
LIMA
PACIFIC OCEAN
D.F.Lev

(Below) Broadcasting unit of the Hayden Planetarium-Grace Eclipse Expedition, at Pira, Peru. Left, Mr. Hans Christian Adamson, Director of Public Relations; right, Mr. William Perry, Announcer of the Columbia Broadcasting System

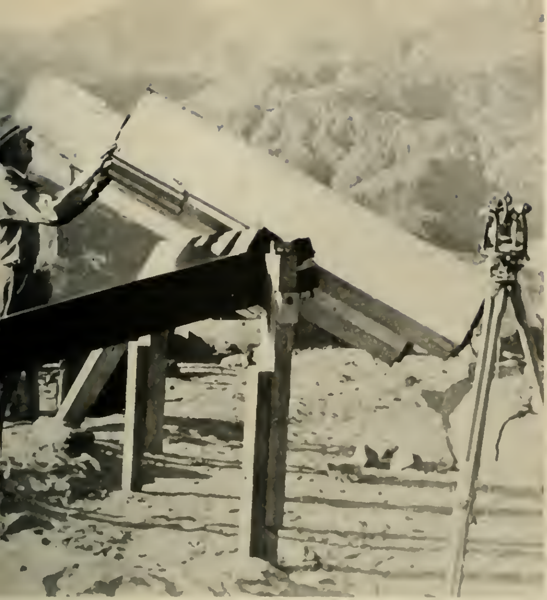


Photo by Serge A. Korff

(Above) STATION AT MORO, PERU: Mr. Dana K. Bailey adjusting telescopic camera at an observation point close to the middle of the path of totality

HAYDEN PLANETARIUM-GRACE ECLIPSE EXPEDITION

(Below) DISTANT VIEW of Eclipse Station at Cerro de Pasco, almost three miles above sea level

Photo by Charles H. Coles

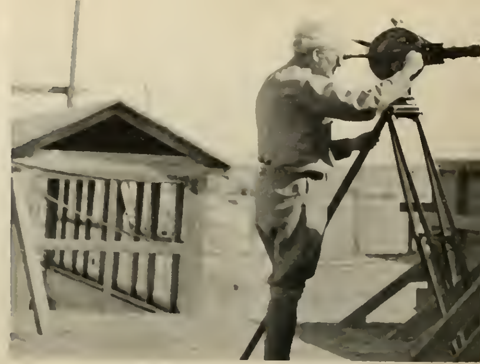


Photo by Te Ata

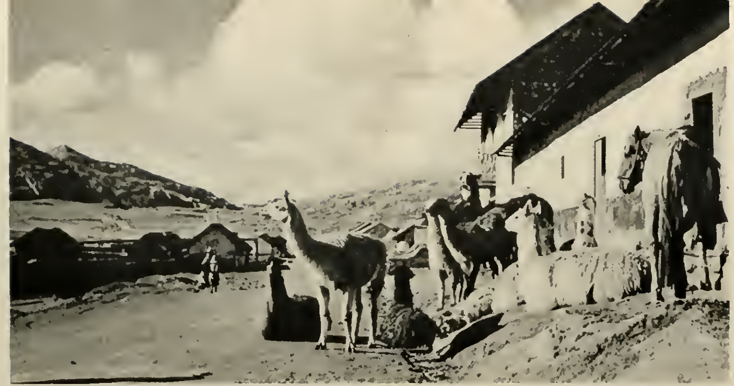
(Above) DR. CLYDE FISHER, Expedition Leader, with his Akeley Camera fitted with telephoto lens for photographing the total eclipse: one phase of the activities at Huanchaco, Peru

Photo by Clyde Fisher

(Above) STUCK IN THE SAND of the coastal desert of Peru: an episode of the 450-mile trip from Lima to Huanchaco

(Below) ANCIENT RELICS exposed by the wind: a vast burial ground of the coastal (Chimu) civilization, more ancient than that of the Incas. South of Huacho, Peru

Photo by Clyde Fisher



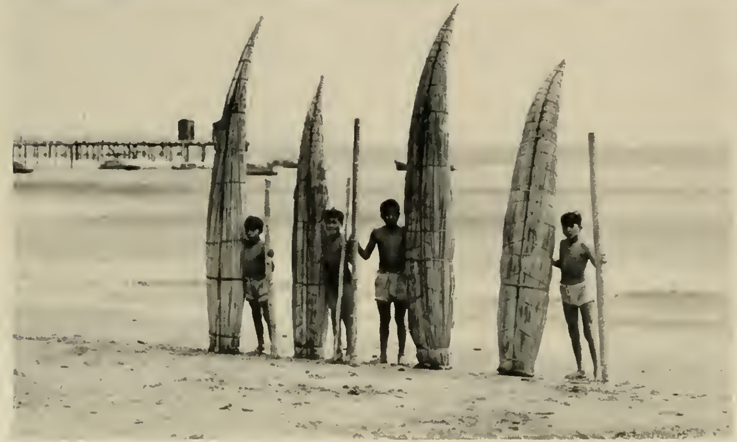
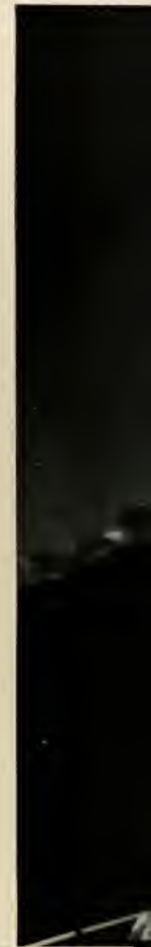


Photo by Clyde Fisher

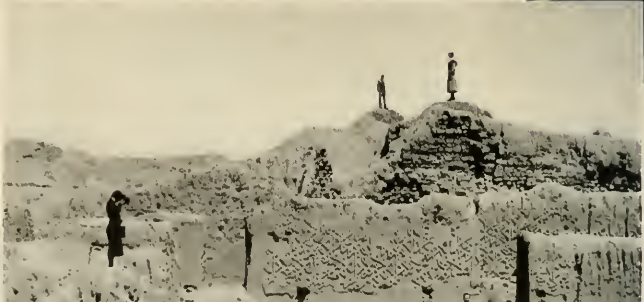
(Top) LLAMAS at Cerro de Pasco, Peru: an animal domesticated before the European conquest and used as a beast of burden

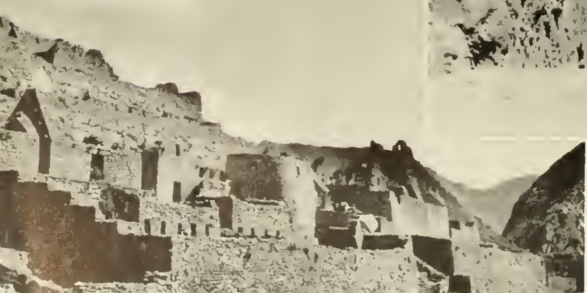
(Center above) SURF-BOARDS: Indian boys with their *caballitos* for surf-riding, at Huanchaco, Peru



(Right) CHAN-CHAN: Great ancient city of the coastal (Chimu) civilization at Trujillo, Peru

Photo by Clyde Fisher





(Left) MANCHU PICCHU: magnificent ruins of the Inca Empire

(Above) SUNSET ON EL MISTI, a volcanic peak near Arequipa, Peru

Photo by Charles H. Coles

(Below) ANCIENT CHIMU FORTRESS AT Paramonga, between Lima and Trujillo, Peru

Photo by Charles H. Coles

Photo by Charles H. Coles

(Above) PERICHOLE PALACE, Lima, Peru: a beautiful example of Spanish Colonial architecture which belonged to an actress who was influential in political circles at the time

Photo by Clyde Fisher

(Left) DESCENDANT of the Incas in native costume playing a reed flute

(Below) MAJOR ALBERT W. STEVENS and Clyde Fisher on the return voyage discussing the evidence of a "globular corona" secured at 25,000 feet

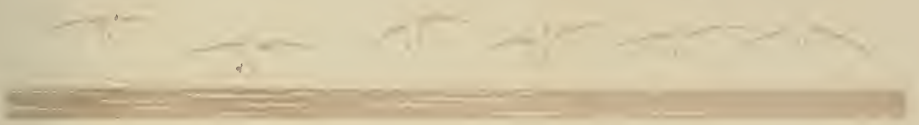
Photo by Te Ata

THE GEESE

A True-to-Life Story

By KERRY WOOD

A modern example of the authentic interpretation of Nature through the medium of imaginative literature, in which the trials and triumphs of a pair of Canada geese observed by the author during their mating season symbolize the world's mightiest drama—the never-ending battle of life



For over an hour the giant gander had led the flock, and now he was weary of the wind's buffeting. The rush of air struck him full force at the head of the wedge-shaped formation, where his sixteen-pound body broke the shock of air resistance for the thirty-odd Canada Geese slanting out in two lines behind him. Flying sometimes nearly a mile a minute and staying on the wing ten to fifteen hours a day, the big birds were all showing signs of fatigue as they neared the finish of their 3000-mile journey from the south.

Smoothly the flock changed formation again, the apex of the V shifting with an easy precision that told of practice. Every bird in the flock had to serve time as flight leader, sharing the hardship. A plump goose forged to the front now, and speed slackened as the new leader adjusted herself to the wind shocks. Protected by the wings of the fliers in front and to one side of him, the gander bugled his pleasure at the restful change. His notes roused the bird battalion, and their honkings carried a welcome message down to the humans on the ground below.

"Spring's here at last!" mankind rejoiced. "There go the wild geese, flying north!"

While the month was April, winter had been reluctant to give up its reign over the land this year. Verdant greenery was bright in the Louisiana marshes where the birds had wintered, but by the time they reached the Dakota states the earth was bleak under them and growth still slept. Once this land had been thickly pocked with sloughs and the honkers had found nesting sites in the wastes. Now only the late stragglers would pause, seeking out the few remaining lakes and streams that suited their cautious requirements. Settlement had spoiled the country for the geese, the humans having brought the curse of drought in their tree-cutting wakes.

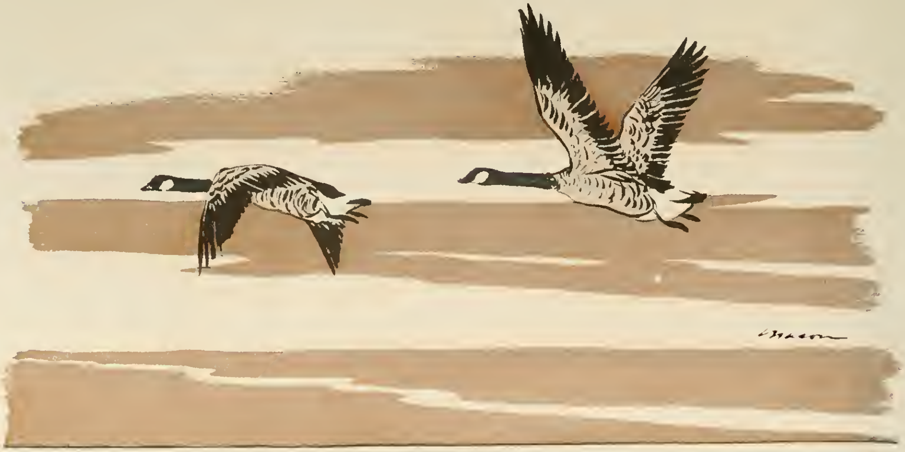
So the flock kept their $5\frac{1}{2}$-foot wings rising and falling in unhurried rhythm above territories that once provided homes for their kind, leaving the Dakotas behind to cross the Canadian Border and reach the Saskatchewan prairies. Here they had to fight a head wind filled with particles of dust-like soil lifting in clouds from the ruined acres. There was little chance of finding nesting places in that dry land, and they veered westward across the prairie belt of Alberta until the Rockies were sighted. Swinging north again, at last they flew over the treed parklands where the silvery chains and pendants of water were ready to welcome them. Their journey's end was near.

The day they reached the parklands the big gander's mate started an excited cackling, low-pitched as though intended only for her consort's ears. During the four years of their mating they had always stopped somewhere in this territory to find nest sites, and perhaps memory stirred as they crossed high above one wide marshland whose shores had sheltered their first clutch. Ten minutes' flight farther on was the ill-chosen lake where they had stopped the second year and lost their young to the vandal hands of humans. Last year the pair's nest had yielded successful harvest, and the goose's gabblings rose volubly as they crossed the Red Deer River and were in sight of the lonely bar that had been their home.

The gander uttered reassuring answer, as though tempering her excitement with good counsel. Evening was spreading a red cloak across the west as the leader pointed beak toward a lake broad on the horizon, and silence settled on the flock as they swerved toward it and circled warily, keeping their altitude while searching the shore-line for enemies. Finally the flock slanted down. Gratefully the tired wings were folded, but before they relaxed to enjoy well-earned rest, every black-stockinged neck stretched high and eyes scanned surroundings with suspicious intentness. Not for nothing were they called wild.

Next morning the gander and his mate did not leave the water when the flock launched aloft to continue the flight. The fliers swung around and came over them, bugling invitations. Honking loudly in answer the gander swam in agitated circles, long neck stretched to watch the flight. But his mate held herself quiet, composedly feeding, and the male would not join the others without her. Soon the birds in the air were a thin waving line.

All that day the pair stayed on the lake, the goose restless and leading the gander a long swim the full length of the water. She explored every bay, every hidden dig, often trundling ashore to investigate the points of land stretching treed fingers out into the waters. While she seemed the adventurous one, it was the gander who identified the tawny form of a coyote crouched behind a bush on shore; and it was his note that gave warning of man's presence when the lake paralleled a roadway used by farmers.



As the sun mounted high the goose became more restless, a strange impatience on her. She was never content, always hurrying on to see what was beyond. Finally back at the shallows where the flock had found good feeding the night before, they rested as the shadows lengthened, taking turns at feeding and watching until night descended.

In the first light of morning the goose spread her wings. That day they explored another nearby lake, a pretty place humans had encircled with many log buildings, that were not yet occupied for the summer. But the place hinted too strongly of man, and the gander kept calling as though coaxing his mate to give up the obsession of exploring the bays and beaches. At length tired of her indifference, the male flapped clear of the water; he had not flown a hundred yards before the goose was at his side, again submissive to his leadership.

All that week they investigated the waterways of the region, returning each night to the proven safety of the first lake's shallows. The female's restlessness became almost desperate as the days grew warmer with spring's advancement. She spent all her time seeking a home, and seemed disdainfully impatient of the gander's sudden vanity in his appearance and his continual parading of his splendid prowess before her. Yet all the time she was covertly admiring him, well pleased with her strong mate.

April was far advanced before the female's quest ended. The home she chose was a wooded island, moated by the split current of the Red Deer River. On a silt mound surrounded by matted timbers she cleaned a site.

To the spot she and the gander took a quantity of dry grass blades, spending a whole day collecting these. Then the female started plucking loose feathers from her breast to serve as the soft, warm nest lining, and the male did likewise, preening out the now useless growth worn on the northward flight.

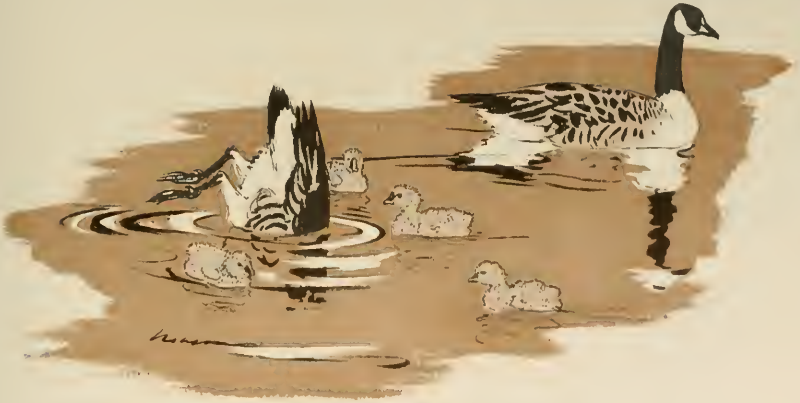
The last dirty patches of snow, shaded on the north sloping banks, had vanished under the magic of warmth. Grass was coming green again, and the smell of tree sap was spicy in the air. On the sunny banks above the river the crocuses made a purple haze, while in the lowlands the willows hung out their silver symbols. Overhead the skies provided busy avenues for thousands of birds newly arrived from the south. A horde of redwings descended like a flashy black curtain on the island trees and raised a cacophony of excitement; mallards ruled the shallows, the drakes sitting up on their curled tails to quack loud greetings to newcomers; meadow larks whistled like cheery workmen as they steered their quail-flights across the river, and killdeer plover uttered plaintive protest at the disturbance. Even the solemn blue herons, sedate on their long stilts, indulged in fantastic, squawking dances as they came under the intoxication of the new season.

The nest was finished, a soft crown for the hummock of flood leavings. Silence settled on the pair and notes were low-pitched for each other's ears alone. At the same time they seemed to have given up the use of their wings, as though cannily aware that their yard-long bodies attracted too much attention in flight. The goose took her throne on the nest, screened behind the logs, while the gander stayed alert but hidden in the young willows a few feet away. A buff colored egg was the treasure they guarded.

The spring was late in the mountains nourishing the headwaters of the stream. Snows melted from the slopes in a rush when the May days came, and as suddenly the Red Deer River was pouring a torrent of glacial waters down its course. Daily the flood rose, the island home of the geese shrinking in size as its soils were claimed for stream-bed. Even the high log pile at the upper end dwarfed itself under the onslaught, and at length the hummock in its center crumpled from sight. Not until then did the angry goose leave the ruined nest. Next day the waters receded, but the three eggs she had laid were gone.

Frantically the goose sought a new site. As though resolved to take no more chances with the treacherous water, she selected the highest nest platform the island afforded. This was a massive jumble of sticks which a pair of red-tailed hawks had been accumulating for the past eight seasons, a huge nest 40 feet from the ground and staunchly supported by the largest tree on the island. The hawks had but recently arrived from the south and had just started to add to the wooden bulk of their nest. No eggs had been deposited, else the female might have used talons on the invading goose. But the gander perched on the edge of the nest platform, a giant sentry, and the hawks, seeing him, did not fly too close, wheeling above their lost holdings and giving out peevish screeches the rest of the day. In the morning they went off to another site on the mainland.

The goose used her beak to enlarge the hollowed surface of the stick nest, then grasses were brought and the feather insulation added, the female plucking herself raggedly bare in her haste to complete the new home. Within two days the place was ready and the second clutch started. Again secrecy was urgent; the gander kept hidden watch on the ground, while the goose hunched quietly above and held her long neck low.



Her lone chore came to an end when the five-egg clutch was complete amid the nest down. Now the patient mystery of incubation started, work that the two birds shared. With all the fussy devotion of a domestic hen the gander settled down to his duty, and never for more than the brief moment necessary to change turns were the eggs uncovered. Seldom do the watchful magpies get a chance to plunder the treasure of a honker's nest.

A family

One hot day in June the eggs showed life, small yellow bills driving through the now brittle shells to release four goslings from the sealed cradles. Both adults were watching them, and gabbled in subdued excitement over the event. When the four were clear of their shells, the mother goose straddled the nest once more, vastly content to feel the small, soft birds take warmth from her gentle body. Occasionally she raised herself to look again at the fifth egg, and finally patience was ended when she glimpsed a feeble motion in it. Her bill enlarged the aperture made by her last born gosling, and her family was complete.

By this time the other young ones were dry of the egg moisture and were piping querulously, wanting food. Coming from large eggs, they were perfectly formed youngsters with open eyes and strong bodies, now covered with a golden down. They were ready to take an active interest in the world around them, impatient over the long wait for the tardy arrival of the fifth brother. So only a few minutes elapsed after the last gosling's appearance and the nest-leaving.

The gander flew down and stationed himself near the trunk below. Then the goose used gentle but relentless bill to push and hoist one of the noisy goslings clear of the nest. For a teetering moment the youngster clung to the edge, then small, unformed wings threshed instinctively as the baby bird tumbled to earth. The gosling bounced robustly on the unyielding ground, but promptly raised itself on sturdy webs, comically shaking its head as it waddled over to take shelter against the gander's flanks. And the big bird put down a sleek head, the bill making a tender, caressing move over the little fellow. The other three early-born goslings travelled the same rough route down from the high nest. There was little weight to them, and their bodies were soft-boned at that stage and took no harm from the fall. In each case they vigorously beat their tiny, down-feathered wings, and this action broke the fall sufficiently to prevent them suffering hurt.

But the fifth bird, a feeble youngster hardly able to raise a protestant voice when the goose pushed him to the edge, fell like a very plummet. Not once did it make a motion of the wings; not once did it struggle to save itself. And when it struck the earth it lay still. Nature has little use for weaklings, and this baby was so weak it had not found strength enough to cope with its first test.

The goose flew down, the four goslings greeting her with shrill peepings as the gander shifted position and forced the little birds to seek shelter with the mother. The male then went over to the fifth baby; he put his beak down and nudged it gently. The little body did not stir, and uncertainly the gander walked around it, uttering a low call as though urging it to move. Once again his bill reached out, but the stiffening body made no response and the big bird seemed vaguely uneasy. A few minutes he spent beside it, uselessly waiting, then he returned to his flock. He started them toward the water. The goose stared a little longer at the dead bird, giving out a short, puzzled note. Then she obediently followed the male to the shallows.

First adventures

From the first the goslings needed no lessons in swimming, eating, or begging. They rolled into the waters fearlessly, their bodies bouyant as cork. The goose took the lead, and tiny webs worked vigorously as the babies essayed to keep close, the watchful gander behind to nudge on the stragglers. Their destination was a weed bed a few yards from shore. Eagerly the young ones attacked the vegetation, ambitiously seizing onto the large, tough stalks that seemed to promise the best feast. These were unyielding, and soon they copied the example of their parents and grabbed at smaller stalks, gulping down the tender shoots. The old birds chattered encouragement, one or the other occasionally putting a head out of sight under water to free a juicy root from the bottom, splitting this titbit into shreds which the goslings could manage. That was when the begging started, hungry petitions for more, and goose and gander were as fondly indulgent as human parents.

Night was spent in the shelter of the old log pile at the head of the island, the young ones snugly hidden under the goose. A few feet away the gander was on sentinel duty, long neck raised high and eyes ever watchful until the shadows deepened into dark and sleep was safe.

That vigilant watch relaxed for a costly moment on the third day after the hatching. Young ones were in the water with the goose at the time, feeding with the choosiness that told of satiation. The male was on the shore nearby, alternately standing guard and taking time to send a cleansing beak through his plumage. He failed to notice when one of the goslings ventured away from the flock, to be caught by the river current and borne strongly downstream. Valiantly the young one struggled against the water's power, trying to regain the family group; he was forty feet down the river before fright mastered courage and his peepings rose in shrill summons.

The goose uttered a startled honk that brought the rest of the brood racing to her side. Instantly the gander plunged from the shore. Before he could get close the tricky current swerved the baby goose into the wide eddy flanking the island, and the moment the downy youngster reached it there was a violent upheaval in the waters and giant jaws gaped from the depths. An agonized last note, then the gosling was jerked from sight.

The gander's wings churned the surface to add to his frantic speed. It was of no avail; the little one had gone. Swimming around the place, the honker bugled loudly, half in mourning for the lost baby, half in vexation that he could find no enemy on which to wreak his vengeful fury. He glimpsed the fish that veered away from the spot, but his eyes missed the limp gosling locked in the big pike's teeth. A moment later a few drops of red lost color in the green waters and that was the finish of the tragedy.

From then on the back water was forbidden territory for the geese. They did not understand the nature of the eddy's evil, but they recognized that danger lurked there.

Indeed, danger was everywhere. Day or night there was no security for their kind. Hunters are ever hungry, and all knew that a plump goose baby was good fare.

A vicious opponent

One time danger came in the form of a tabby, strayed from some farmer's home. Size for size there is no more deadly hunter in the wilds than a soft-footed domestic cat that has forsaken the comforts of a hearth to savour again the well remembered freedom of the woods. This one was large, sleek with the good feeding its claws had provided. It came stealthily through the undergrowth toward the clearing where the goslings were relaxed in the luxuries of a dust bath. The goose family was on the main shore at the time, the parent birds stationed near the water. Closer and closer to the unsuspecting young ones came the enemy; but a curious bluejay had glimpsed the stalker, and before the cat could spring on its selected victim, the bird's excitement burst forth in shrill denouement. At once the gander gave heed, his note making the youngsters alert.

The cat dismissed caution and streaked toward them from the bushes with claws unsheathed for killing. Squawking madly, the young birds managed to flop clear of the beast's first rush, and quickly the goose lunged her body in the way. Her wings slapped the animal off its feet and rolled it in the dust. The cat came up snarling. This time its green eyes focused on the largest bird of the flock, the gander who advanced with black beak held close to earth and hissing loudly. Swiftly the cat launched at him, leaping for the bird's head and reckoning not on the upraised wings. The giant pinions flashed down and one struck the animal's back in mid-air; there came a sharp crack of breaking bone, and the cat's screech of hate sirened to silence. Even the thick bones of a human's arm could have been fractured by those deceptively powerful feathered weapons.

Fight with snake

Another time the goose raised wild chatter and the gander saw the long, thin body of a garter snake undulating across the beach. The snake had not looked at the goslings, too large for its omnivorous maw, but there was a shrill, fear-inspired note in the goose's alarm and the gander's charge was cautious, as though dread tempered his anger. His wings could do little damage to the snake, the rocks and earth protecting its low-slung body from the striking feathers, but suddenly the honker's beak flashed out and the reptile writhed in a paroxysm of pain. The head had been nearly severed, and the gander's next thrust finished the decapitation. Still the snake's body threshed, and again and again the beak shot out to cut the jerking ribbon to bloody fragments. Then, honking loudly, the bird drove his brood away from the spot with a haste that belied his victory.

On another day the danger came from above, a rush of wind heralding the menace and sending the half-grown goslings to cover just in time to avoid the talons of a fierce-eyed Goshawk. The falcon almost crashed the underbrush, so intent was it on getting game. Then the gander's form reared in its way and a long wing brushed the hawk's arrowed body off balance. A harsh cry of rage came from the Gos as it righted itself, whirling as though to attack the giant waterfowl. But there were two adult geese ready for it now, a steady courage about them that quenched even the fiery lust of the falcon. For a glowering moment it poised, then a passing gull gave it an excuse to swerve away in pursuit of a new victim.

All such dangers taught the young geese hard lessons about life. They began to understand the ceaseless vigilance of the old ones, and at intervals the small heads turned sagely, grave eyes scanning the shore-line, glancing aloft, then turning to glimpse the expanse of water out from land. A hawk's shadow brought a low gabble from them; the presence of a black and white skunk, nosing along the beach in search of anything edible, sent them quietly out to mid-stream; the yapping of a coyote brought their heads up in heedful attention.

They learned to discriminate, too. The strange booming of the snipe, hovering above the river marshes in the early evening, was catalogued as of harmless portent; the black form of a quill-rattling porcupine, lumbering across their island to divide the distance of a river swim, could be ignored with safety; the dainty presence of a deer, come to drink in the early morn, was no menace to their kind.

And there were many ways of knowing when surroundings were safe or not. For instance, the tall blue heron had both sharp sight and acute hearing, and in the shallows where it waited on patient stilts for unwary frogs and fish, a goose could be sure of momentary peace. The friendly sandpipers, on the other hand, were unreliable sentinels, trusting overmuch in their small size and quiet colors to save them from predators. Those big bark-eaters, the beavers who had a domed lodge up the river, could scent and hear evil from afar, and a resounding tail slap on the waters was a danger signal for all to heed. But the fat muskrats took many chances when enemies were near, sure of their fast diving abilities to save themselves. Crows were always wise, so when a flock rose in sudden flight there was always a reason for caution.

All this the growing goslings learned, and a canny, proud wildness was brewed in their blood.

The parent birds lost their feathers when the hot days of August came, the moult stripping them almost bald of outer covering and robbing them of the power of flight. During the two-week period they were thus denuded, gander and goose kept close to the island, dangerous of temper because of their unkempt helplessness.

As the adults took on a new growth the young started to show the heavy matting of flight feathers, and all five birds spent much time preening plumages into order. It was then that the goslings began to stretch and flex their rapidly maturing wings, perching on shore rocks and flapping the big sweeps in slow, experimental strokes that sent blood coursing through the dormant muscles soon to be so important. Quickly the wings lost clumsiness, and shortly the time came when the youngsters strained out their necks and the wing beats pulsed with glorious purpose. The advent of flight was their college education, widening their world.

At first the old birds led them a cautious course above the river, but the flying range was gradually extended as the young mastered the higher altitudes. Gander and goose never failed to utter the brief alarm note every time they sighted man or his board-made handiwork, and soon the young ones followed this example, gabbling warnings among themselves and forging higher in the hot skies without realizing the reason for their wariness. There was frequent practice for such caution in the days that followed, flying over the square-patterned gold of the grain fields, steering high above the sprawling farm buildings, skirting the noise-wracked small towns where the ugly red elevators reared importantly against the sky line. But as yet the goslings did not know why man was classed as goose-kind's most dangerous enemy.

First lesson of that came one day when the wheat sheaves stooked in a nearby field attracted them, the flock circling and settling in the center to raid the ripening grain. It happened that the farmer had noticed their landing.

"A flock o' geese!" he pointed them out to his hired man. "Gosh, it's bin years since I tasted roast goose!"

"Too bad the hunting season isn't open," commented the other. "It's still two weeks until September 15th."

The farmer winked: "Who's to know if it's open season or closed season, 'way out here ten miles from town?"

"Well; no one, I guess."

" 'Nother thing, I got a goose comin' to me, you might say, seein' that I ain't shot one for so many years. Eh?"

"Maybe. But I hear they're getting scarce."

"Bosh! Why, I saw a flock go south last fall that must've had a couple hundred birds in it. Just one flock, mind you! I bet there's millions up north."

The hired man held his tongue. He had located this job only a month before and could not afford to be argumentative.

"No one's going to miss a goose or two out of millions," the farmer declared, and he fetched his ten gauge gun from the house. "Now look; I'll angle off there through them trees and make a detour 'round the whole field. I reckon it'll take me half an hour to reach the willows 'longside the river, an' I want you to wait that long an' then cross the field toward the birds. That'll scare 'em up, see, an' I'm bettin' they'll fly for water an' I'll maybe get a shot as they go over."

Death in the air

Later, it was the gander who noticed the human leave the distant buildings and cross the stubble toward them. His summons sent the birds aloft, and, just as the farmer predicted, they flew toward the river.

Misfortune directed their course over the hidden hunter, and suddenly the gander seemed pushed upward by a strong blast of wind. Instantly the bird shrilled an alarm, the warning given even before the rest had noted the puff of smoke or heard the thudding boom of the gun. The goose and two goslings obeyed the leader's cry, putting power into their wing strokes to lift them high and sideways. But the third gosling was curious, ogling down at the willows. He ventured closer just as the farmer threw caution aside and rose in plain sight. Blue smoke streamed from the gun a second time, thunder rocking skyward, and a terrible pain wrenched a last despairing call from the young bird. Then its body crumpled and dropped.

"Goose for dinner!" yelled the farmer, running to claim his prize.

He did not notice the stiff, slow flight of the gander, lagging behind the other birds. He did not see the faithful goose circle back, calling to her mate. Blood was dripping from the honker's breast and a dark power was dragging him close to earth. The island home seemed far away.

Fall activity

Now September laid its lavish brush upon the land. Frost strewed diamonds among the grasses over-night, while the clear waters hardened into thin films of ice at the shore-line. Wading birds protested at this, the frozen mud warding off their grub-questing bills. A restlessness had come upon the mallards, convening in large flocks and endlessly setting out on flights above the river valley. Far above, one and two miles high in the blue, myriad numbers of warblers hustled south. Swiftly the beavers worked, cutting saplings and tender-barked woods and weighting them to the river bottom in bays near their lodges. Gophers whistled a last time in the fields, flicking their tails as they dived into dens and disappeared for the seven months they would stay underground. A doe sauntered to the water, an antlered buck proud at her heels and eying the world distrustfully. Mournful rose the coyote's lament, floating up to the orange moon and bewailing the hungry months to come. Mostly there was silence, tense and expectant throughout the land.

The short days sped by and still the gander could not leave the island, now become a prison for him. Blood had long since faded from his plumage, but under the feathers rankled deep wounds. His beak had explored the injuries, seeking the leaden pellets that festered and pained. Then followed the healing, a tedious period of waiting.

At first the goose and goslings were content to stay near the leader, the flock foraging in the nearby weeds. Then, as the zestful days went by one after the other in monotonous succession, the wings of the healthy birds yearned for the broad space of the sky. The goslings yielded first, launching aloft one morning. Protesting, but with the duty of leadership strong in her veins, the goose flapped after them. Frenziedly the gander on the ground sought to send power into his pinions. He raced along the length of the island under the fliers and plunged into the waters, seeking to swim as fast as flight. All the while his far-searching notes called them, loud with anger and plaintive with lonely appeal. The three birds wheeled back and slanted down to the water. The gander's pleasure was unmistakable as he swam among them.

But the skies were vast with adventure. Every day the little drama was repeated, the young rebelling at the wait. Reluctantly the goose would fly after them in brief flights around the spot where the gander continually made his presence known. Always the goose stayed within sight of him, soon coasting back to earth to be with her consort.

Then came a day when a wedged flock was sighted, whose spaced honking told they were in long flight. Eagerly the ground birds interrupted the migration song, bugling invitations. The fliers responded full-voiced; and thankfully they eased down, folding tired wings in the waters nearby. A bedlam of gabbling broke out as the sociable birds mingled.

In the morning at the parting the two goslings were in the ranks as the flock rose. Despairingly came the gander's plea, the goose noisy at his side. It was not the loss of their young that hurt, for the parent instinct was finished for that year. But they mourned desertion by the flock, gregarious instincts fully aroused at this season. The flock veered back, calling to them, and the gander elevated his wings as though to make an attempt to join them. Yet he realized the hopelessness of the effort before the test was made, raising louder plaints. But the fliers did not tarry. Soon they had climbed to the level of a flight lane, marshalled in formation with necks reaching toward the distant south. Their honkings took on a regular chant, almost marking time for their wing beats.

Portent of winter

The first snow fell wet and sticky, clinging to trees and earth and rocks. Only the river flowed clear, steaming a little as it pulsed past the island where the geese huddled. The storm drove the other waterfowl from the stream, first the whistlers and buffle-heads, next the mallards whickering away to southern rice-fields. Slim teal flashed by, rocking with the speed of their flight, and high above streamed the black hordes of coots. Soon it seemed that the geese were entirely alone.

A miserable week was passed, then warmth returned through a gap in the mountains and the chinook freed the land. Indian summer came, a mellow season of golden days and frost-tinged nights. The geese grew fat, ranging on the main shores to raid the farm fields. Stooks had been lifted and the engine-noisy harvest done, but the stubble was pocked with waste kernels. There was also good feeding in the shallows again, for the river had receded and the geese could now reach the roots of deep growing weeds that summer waters had protected. Greedily they fed, building up body fats that provided insulation against the cold nights.

Winter was on its way. The countryside was nude of growth, the drab earth ready to be covered with snow. Some days the clouds rolled grey, scudding ahead of a stinging wind. Then the sun shone again, arcing low over the horizon. Silence was softly throned, the tenseness gone as nature relaxed for sleep.

The goose became uneasy, honking intermittently through the day, and as though aware of the reason behind her fears the gander made valiant preparations. Daily his giant wings lifted, at first beating hesitantly against the stiffness of the injured muscles. Gradually the soreness worked off and his strokes lengthened, but still he would not leave the island. The goose's vocals became incessant as she forecast the blizzard that was soon to wrap the land in winter.

Driving ahead of the storm in mid-November came a hundred-bird flock of the Canadas. The gander's quick eyes identified them first and he promptly raised a greeting. No answer came from the flock, almost a quarter mile high and noisy with their own notes. Gloriously they sailed along, emblematic of the freedom of wild things. Sighting them, the female could not hold still; she threshed broad wings and climbed skyward, clamoring up at the fliers. But stronger than the flocking impulse was the lifelong tie of mates, and in a moment she slackened her ascent and wheeled back toward the island. Her flight had roused the gander from his cautious lethargy; just as she turned the big male sprang into the air, his great wings laboring as he rose above the well known river. Gladly the goose hurried to his side.

Southward bound

The honker's pinions acquired more surety, and the two birds called urgently as they strove to mount the roaring wind. Then the leader above heard their desperate clamor, sighted them, and slacked the flock's speed. Spurting again, the pair climbed to the flight lane and an eager chatter of welcome came sweetly to them. In another moment they had gained positions in the V and the migration music resumed its rhythm.

AN ALBINO TARPON—*How the only recorded specimen was captured and how it came to the American Museum*

By E. W. GUDGER
Associate Curator of Fishes,
American Museum of Natural History

SHORTLY after I reached my desk in the Museum on May 21, 1936, the following telegram from the Boca Grande Fishing Club was brought to me.

> CAUGHT TWENTY-FIVE POUND VERY INTERESTING EXAMPLE OF ALBINO TARPON LOOKED LIKE GOLDFISH WOULD MUSEUM LIKE HIM AS GIFT MOUNTING HIM ANSWER
> OLIVIA ERDMANN KUSER

This telegram excited me very much. Albino marine fishes are sometimes found, particularly among flatfishes. But even in these, pure albinos are rare, most of the so-called albinos being piebald, "half and half." No one has ever heard of an albino tarpon. Could this be a real albino, or was it a tarpon simply less silvery than usual? These and similar thoughts raced through my mind as I held the telegram in my hand. If it were an "honest-to-goodness" albino it would be a treasure. But was it?

Then there was another consideration. We have three or four mounted tarpons in the Hall of Fishes, particularly the splendid one whose portrait is seen in the accompanying photograph, all beautiful silvery fish. Our collection of big game fishes is already crowding our walls almost to the limit, and only those of particular value can be accepted. So we have adopted the principle of accepting for exhibition no fish "sight unseen." Hence I answered as follows:

> INTERESTED BUT CANNOT ACCEPT FOR EXHIBIT SIGHT UNSEEN IF YOU SEND EXPRESS COLLECT WILL RETURN PREPAID IF UNSUITABLE
> E. W. GUDGER

How the albino tarpon was caught

I heard no more about the albino tarpon until May 25, when Mr. and Mrs. John L. Kuser called at my office. I then got the story of the capture of this unique specimen, and how after its capture Mrs. Kuser had with great good judgment at once taken the fish to Ike Shaw, a capable taxidermist at Fort Myers, Florida, for mounting. When mounted, it was to be sent to me as a presumptive gift for the Hall of Fishes. Mrs. Kuser expressed the great pleasure that she, as a member of the Museum, would have in presenting to the Museum this unusual specimen. Here follow the facts as to how this unique specimen was taken.

The capture

Mrs. Kuser went out tarpon fishing very early on the morning of May 20, 1936, to catch the turn of the tide when tarpon are feeding. The scene of operations was in Boca Grande Pass on the west coast of Florida between Cayo Costa and Boca Grande Islands. The pass is a strait or channel between the Gulf of Mexico and Charlotte Harbor. It is one of the most celebrated tarpon waters in the western world. In this pass and in adjacent waters, Julian A. Dimoch took his marvelous pictures of leaping tarpon—some of which are shown herein.

Mrs. Kuser was out in this pass in an ordinary fishing boat with Leland Willis as boatman and guide. Her outfit, that of the usual tarpon fisherman, was a no. 9 vom Hofe hook on a wire leader attached by a swivel to an 18-thread line, and a 4-0 reel and a 9-oz. tip. The bait used was a crab with its big claws broken off. This outfit successfully brought in the albino tarpon, which weighed 27 pounds.

When the fish was hooked, and all through the struggle to bring it to the boat, there was nothing to

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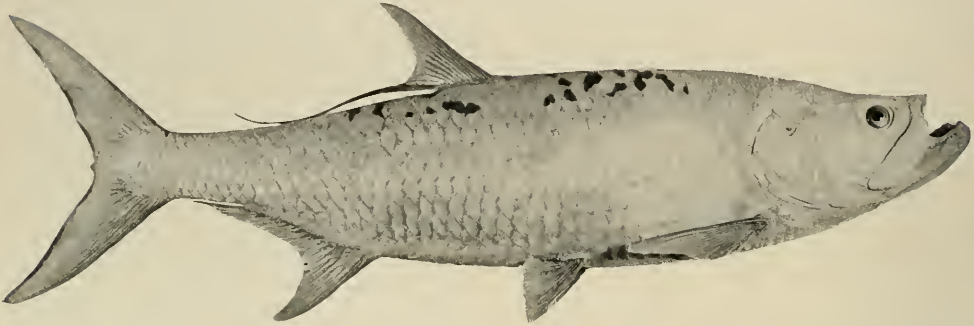
E. W. GUDGER is perhaps the world's most noted investigator of abnormalities in fish, and certainly the most prolific writer on the subject. The article above discusses his latest discovery in this field with which he has been so closely connected for ten years as Associate Curator of Ichthyology at the American Museum. The most celebrated work done by Doctor Gudger on unusual fishes is his research on the rare whale shark. He has written the histories and geographic distribution of 76 out of the total of 80 specimens of this fish that have ever been recorded. Doctor Gudger is well known to scientific circles as the editor of the monumental Bashford Dean Bibliography of Fishes—the most encyclopedic of all books on Ichthyology indicate that it was not an ordinary tarpon. Nor did the glimpses of the fish, when it came to the surface or made short leaps, prepare the angler for what was to come. When the fish was finally brought to the side of the boat and they could see the white body with faint gold and reddish scales, the pink eye and the orange red mouth, Mrs. Kuser could hardly believe her eyes and the boatman nearly went overboard in surprise and in his efforts to secure the fish as a specimen without gaffing it. The second photograph represents as near as can be what the angler and the boatman saw in Boca Grande Pass that memorable morning in May, 1936.

That the reader, unacquainted with this interesting fish, may get some idea of the normal fish and its behavior it may not be amiss to set out briefly some pertinent facts about its natural history. These will serve as a background against which to project the albino fish.

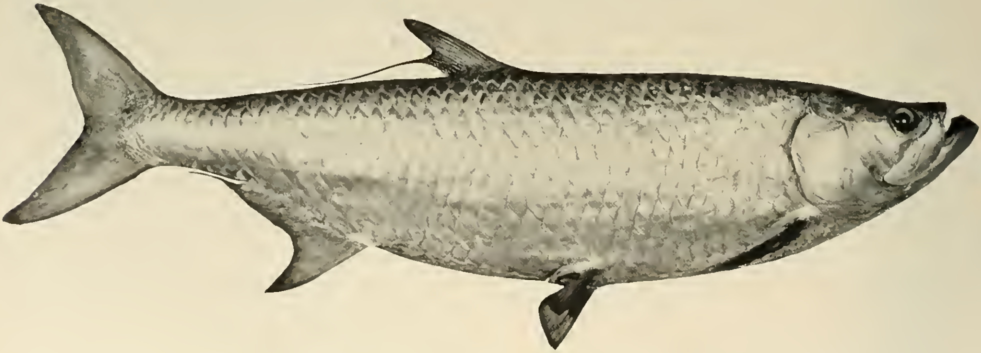
First of all the tarpon grows large. The mounted normal fish illustrated is a large, full-bodied specimen. It is so large and heavy that one does not realize that it is nearly 7 ft. long. As this figure shows, the tarpon has its great body clad in a coat of mail composed of huge silvery scales. In Florida and elsewhere these beautiful scales are sold as souvenirs and are used in making calling cards and various ornamental objects. Because of these large silvery scales, the fish has long been known as grande écaille, silver fish and silver king. As I have seen the fish in the clear waters of southern Florida, it justifies the name "silver king." The tarpon in his shining armor is truly a regal fish. It might appropriately be called the king of the herrings since it is the largest of his tribe. However, just here it should be noted that while the sides of the tarpon are silvery, its back and its fins are dark in color—in life a deep metallic purplish blue.

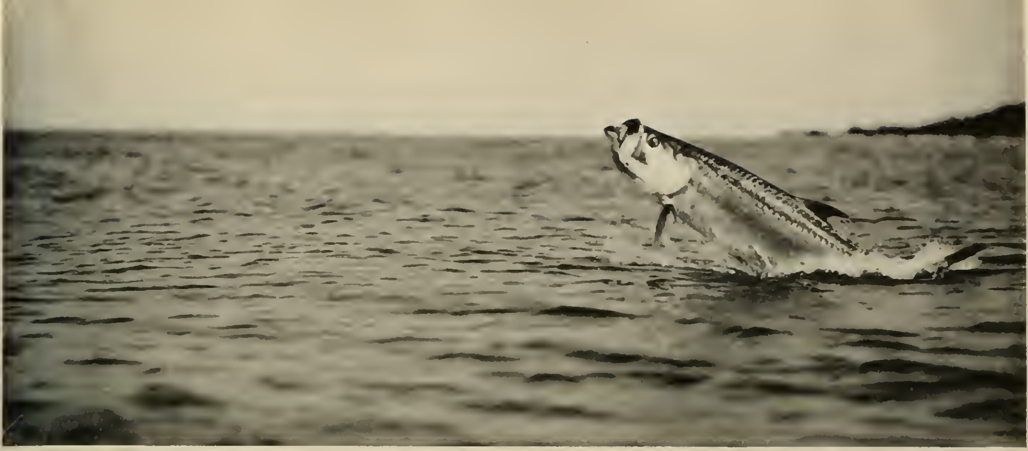
The tarpon is also characterized by its large eye (hence its generic name, *Megalops*), and by its



(Above) THE ONLY ALBINO tarpon ever exhibited; white with glints of gold and delicate orange-red stippling. The few dark scales suggest normal coloring

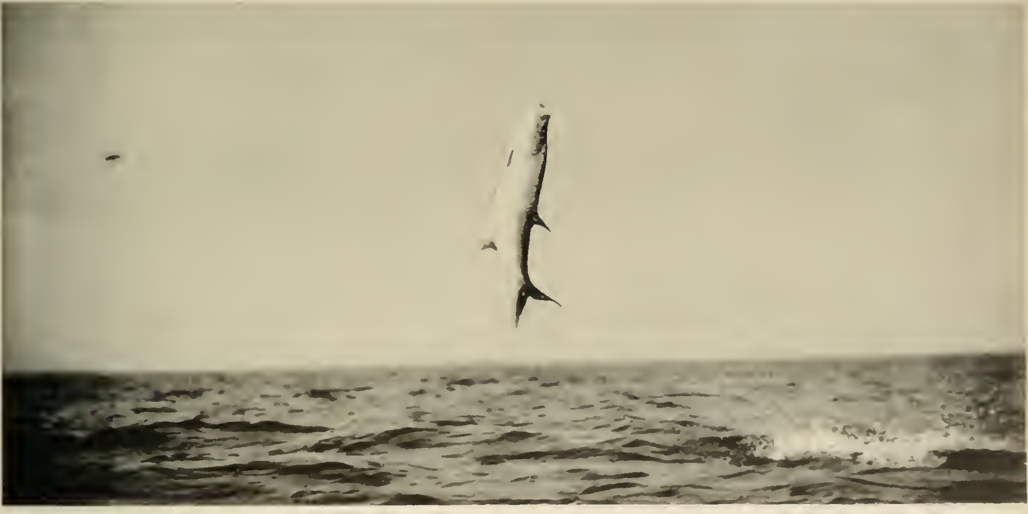
(Below) THE NORMAL TARPON: a regal fish much sought after by fishermen. In life its scales are deep purplish blue on the back, silvery on the sides





(Above) A LEAPING TARPON emerging from the sea at the beginning of its flight: a remarkable action photograph taken in the very waters where the albino was caught. The tarpon leaps not only when hooked but when free, perhaps to free itself from sucking fish and parasitic crustaceans—or just for the fun of it

All AMNH photos, courtesy of Julian A. Dimoch



(Above) THE TARPON in the air at the peak of its leap. The tarpon attains a length of 8 feet; the record on a hook is 209 pounds

(Below) "GOING HOME": The tarpon falls back into the water with a resounding splash, finishing an exercise that has won it a unique reputation

lower jaw, which is strong, projecting and terminates in a bluntly conical "chin." Characteristic also is the hindermost dorsal ray which is produced into a long filament or whiplash. The anal fin is situated far back and its last ray is also considerably elongate. The tarpon attains a length of 8 ft. The heaviest recorded as taken on a hook was 209 pounds, and the largest secured with a harpoon was 383 pounds —if the record is correct. However, an ordinary full grown fish is from 5 to 6 feet long and weighs from 100 to 150 pounds. Specimens weighing over 100 pounds are "large" ones. The albino weighed 27 pounds when caught, and mounted measures 4 ft. 5 in. long. A small mounted specimen presented to the Museum by Mrs. L. M. Perry of Sanibel, Fla., measures 8 in. "over all."

The tarpon is a prize much sought by fishermen because of its beauty and size, and possibly even more because of the great leaps it makes not only when hooked but when free. The accompanying series of photographs show a tarpon just emerging from the water, in full flight, and falling back into the water with a great splash. These photographs were taken in the very waters where the albino was caught.

The tarpon is one of the high leapers among the bony fishes. It not only leaps when hooked and in the endeavor to throw the hook, but it is thought to do so to free itself from attached sucking-fishes and from parasitic crustaceans, but I am satisfied that it also leaps out of sheer exuberance—just for the fun of the thing.

Some personal observations may be in order here. On the Gulf side of Sanibel Island (off Fort Myers and the mouth of the Caloosahatchee River), I have seen tarpon rolling half out of water and making short leaps evidently just because they "felt good." While fishing for them in Captiva Pass (between Captiva and Cayo Costa Islands, about 12 miles south of Boca Grande Pass, where the albino was caught) I have seen tarpon "rolling," "breaking water," and making short leaps. None, on this particular occasion would bite, but they came close to our boat in their gambols, and one, in a spirit of bravado or contempt (at least so some of the party alleged), came within three feet of the stern of the boat and splashed water on the book of a lady seated there reading.

The names tarpon and tarpum are probably of Indian origin. The Atlantic fish was formerly called *Megalops atlanticus* but its present nomenclature is *Tarpon atlanticus*. Its nearest relative is *Megalops cyprinoides* of the Indian Ocean and the waters of the East Indies. The name *Megalops*—big eye—is fittingly applied to our fish.

How the albino tarpon came to the Museum

This specimen, the only mounted albino tarpon in any museum in the world, came from the taxidermist on September 28, 1936. I took one good look at it and decided instanter that it was our fish. Later Mrs. Kuser came to see it and was as genuinely pleased as I at the excellent mounting of it. What little faint pink color the fish originally possessed had, of course, been largely taken out in the process of degreasing the skin, and I had advised the taxidermist that it come to us uncolored. So it came and, when she saw it, the generous donor offered to pay for putting on what slight color it had possessed, from her notes made at the time of capture. Furthermore, the day being appointed, she came bringing with her a little live goldfish showing the black spots on the back and the exact shade of orange for the fins, the head region and the back. The coloring then was done with her standing by and "bossing" the job. Thus the Museum came into possession of this splendid specimen of the albino tarpon with its color accurately shown.

How the albino tarpon looks

This fish *is* an albino. The general body color is white with glints of a very faint yellow gold, so faint that one hardly sees it at first. Then over all is a faint orange-red stippling. Above the lateral line, the orange tinge is more discernible, and it grows stronger toward the mid-dorsal region. The dorsal surface, instead of being purplish blue as in the living normal fish, is a faint orange-red and has a few dark scales suggestive of the normal coloration. The fins are a fairly deep orange-red, the deep color of the basal parts growing fainter toward the edges which were transparent in life. The head parts show the same reddish tint, especially in the gill region, the eye is the typical pink of the albino, and the front of the mouth is orange color.

None of this coloring save the black shows up in the photograph. Significantly enough, the flesh of this fish when fresh was pinkish (albino coloring?) or salmon-colored, whereas the color of the flesh of an ordinary just-caught tarpon is white.

Albinism, the congenital deficiency of pigment in the skin and eyes, is a phenomenon fairly well known in all the great divisions of vertebrate animals. Albino men are occasionally seen. Among other mammals are albino deer, rats, porcupines, red squirrels, etc. In albino ("white") rats, as in albino trout, the white color is carried over regularly to the offspring and we have distinct races of albinos. Albino birds are sometimes seen, as are snakes, frogs and salamanders.

Continued on page 700

SOUTH AFRICAN ROCK PICTURES—*Striking artistic achievements of prehistoric man, which tell a story of the dim past and inspire modern artists with their technique*

By N. C. NELSON

Curator of Prehistoric Archaeology, American Museum of Natural History

PRIMITIVE art, both ancient and modern, has long received special attention from the anthropologists and, judging by museum experience, is gradually winning its way also in popular esteem. The reason perhaps is not far to seek. Art has a wider and more instant appeal than science; for while we may appreciate beauty at first glance, time and study are required to reach an understanding of the technicalities involved even in art itself. The reference here is not to music, singing, dancing or story-telling, but to decorative and pictorial art; that is, to permanent objective representations such as in one form or another are profusely exhibited in every anthropological museum.

In the case of the American Museum of Natural History, still adhering to the scientific mode of mass presentation, the artistic features of our various regional exhibits are studied and copied annually by hundreds of art students, with the result that many of the sometimes ancient design elements have long since been readapted to modern usage. A few museums have actually sought to meet this popular demand by rearranging their exhibits so as to stress the artistic features.

There are two special reasons for commenting on primitive pictorial art at this time. One is that the people of New York City were privileged not long ago to view the reproductions of a large series of native African rock pictures brought by Professor Leo Frobenius from Frankfort-on-the-Main, Germany, and exhibited at the Museum of Modern Art. Professor Frobenius has given a lifetime of study to this type of art, has conducted no less than twelve expeditions to widely separated regions of the African continent, has copied thousands of pictures, and has published extensively on the subject. The other reason is that the American Museum has itself recently acquired the series of carefully made copies of similar rock paintings accompanying this article. These were selected from a large series offered for sale by Mr. M. K. McGuffie, a South African artist who has also devoted much time to the study and whose work has been duly complimented by Professor Frobenius himself.

The McGuffie reproductions herewith illustrated all come from one of the richest rock-painting localities in the world, namely, the eastern portion of Cape Province in extreme South Africa, as shown on the map on page 654. Within an area, measuring roughly seventy miles from north to south and one hundred and fifty miles from east to west, over one hundred localities are indicated in which more

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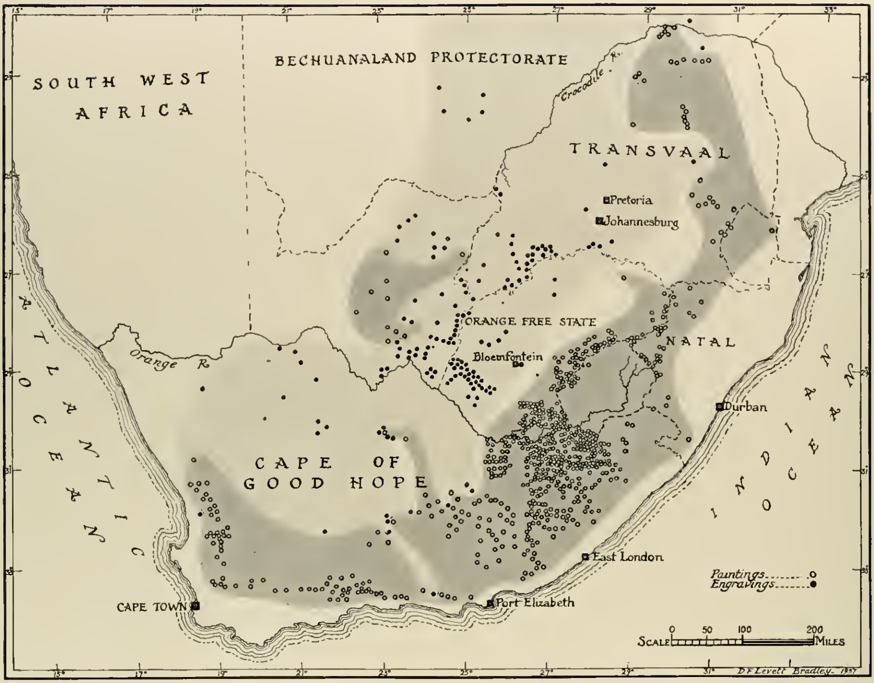
NELS C. NELSON, one of America's most eminent archaeologists, was born and raised on a farm in Denmark. Recalling his early education as a Minnesota farm boy (he emigrated to this country in 1892), Mr. Nelson tells that at the age of seventeen he was spelling C-A-T among classmates that came only as high as his knee. He first became interested in archaeology while attending the Omaha Exposition of 1898 where a graphic history of Man's tools was on display. Mr. Nelson was both a student and a teacher of Anthropology at the University of California and it was in the San Francisco Bay region that he conducted his first major investigations which were later expanded to include the American Southwest. Since that time other sections of this continent together with western Europe and parts of Asia have been explored by Mr. Nelson. As Curator of Prehistoric Archaeology at the American Museum he was in charge of the archaeological branch of Roy Chapman Andrews' Asiatic Expeditions. Mr. Nelson has held official positions in several scientific societies and is an active member of many others. Among the varied archaeological phenomena that have come within the broad scope of his work, are the prehistoric cave drawings of ancient man.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D. F. Levett Bradley 1937

ROCK PAINTINGS AND ENGRAVINGS

Note the abundant sites where this type of primitive art has been found in South Africa. The darker shading indicates the distribution of paintings, the lighter that of engravings. Though the two modes of pictorial representation were presumably the work of the ancestors of the Bushmen, their distribution does not overlap to any marked extent. The drawings reproduced in this article all come from an area approximately 70 by 150 miles (26-29 degrees east and 31-32 degrees south), in which over one hundred localities are indicated

(After the Bureau of Archaeology 1936 map, Department of the Interior, Union of South Africa)

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or less extensive groups of rock paintings have been discovered. As seen on the map, however, this area contains only a small fraction of the known art centers in South Africa. Except near the coast, where rock paintings do not occur probably owing to the absence of suitable rock surfaces, they range over a zone in places two hundred miles wide, which parallels the coast for more than fifteen hundred miles. Farther inland, behind this curving zone of rock paintings, there is an equally extensive explored area characterized chiefly by petroglyphs or rock engravings. Curiously enough, although the two modes of pictorial representation were presumably the work of the same people, namely, the Bushmen, their geographical distribution does not appear to overlap to any marked extent.

World distribution of mural art

In passing, it must be made clear that prehistoric rock pictures, both painted and engraved, are not confined to South Africa. Their distribution is world wide. They occur, for example, also in Southwest Africa, in East Africa near Lake Tanganyika, and in various parts of all North Africa, including what is now the Sahara desert. In Europe, relatively recent, i.e., Neolithic, Bronze and Iron Age inscriptions, more or less pictorial, are found in Sweden, in the British Isles, in Belgium, in northwestern France, in northwestern Spain and in Italy. A small series of more ancient rock pictures occur in Russia and Norway; but, as far as is known, the most ancient and in some respects the most noteworthy examples of prehistoric mural art are confined to the caves and rockshelters of southern France, as well as parts of northern and eastern Spain. Asia has furnished at least a few examples from the Near East and from India, and the writer has himself observed a considerable number of rock engravings in Outer Mongolia. Even far-away Australia has supplied some striking examples of both rock engravings and cave paintings. Lastly, needless to say, rock pictures of all types are also an outstanding archaeological feature of both North and South America, being especially numerous in our own Southwest, where conditions for their production and preservation have been particularly favorable.

Mural art styles

Turning now to the Old World, specifically to Europe and Africa, and taking Frobenius for our principal guide, we learn that this vast region is characterized by two distinct art styles. One of these styles he calls Franco-Cantabrian and the other Levantine or Eastern.

The first and probably the older style, best known from southern France and adjacent parts of northern Spain, but found also in various regions of Africa, as, for example, the Atlas mountains, southern Tripoli, and far-away South Africa, is characterized by isolated or individual representations of mammals, birds, fishes, insects, and human beings. These pictures are mostly polychromes, done sometimes to a scale approaching natural size and often in the manner of faithfully rendered natural poses.

The second or Levantine style, typical of eastern and southeastern Spain, southern Tripoli, the Libyan desert and South Africa, is unique in that the pictures are usually small scale monochromes and represent real compositions or groups, illustrating for the most part hunting or dancing scenes. These pictures are executed in a slightly conventional manner, as may be seen in some of the accompanying illustrations.

The first or Franco-Cantabrian style Professor Frobenius calls "portrait pictures," and the second or Levantine style "action pictures." As the reader must have noticed, the two styles occur together in at least two places, namely, southern Tripoli and South Africa; but in the opinion of several students the first or Franco-Cantabrian style is the older. Apparently, therefore, the two art styles, imitative and interpretive, were practiced by different peoples, through whose various migrations the separate traditions were carried in several directions from the points of origin, probably the lands bordering the western Mediterranean. Professor Frobenius himself appears to maintain the view that both styles originated in southwestern Europe and from there by degrees spread, for example, to South Africa, the Franco-Cantabrian style being the first to arrive. He also regards the African pictures as ranging in time from about 10,000 B. C. down to the present day.

The beginnings of art

As cultural documents these cave wall pictures, aside from their esthetic value, constitute one important phase of the middle portion of a long, many-sided story—the story of the development of human civilization. Briefly told for southwestern Europe, where alone it has been well worked out, the art side of this story—giving us the true setting of our South African pictures—is about as follows. Artistic expression, viewed historically and in the large, began in Upper Paleolithic times, some fifteen or twenty thousand years ago, as a crude imitative or realistic endeavor, which slowly improved and then by degrees underwent a process of stylization or schemetization, amounting throughout the succeeding Neolithic Age to almost complete degeneration, at least as far as copying nature was concerned.

At first sight this transformation strikes one as perhaps the natural and therefore the universal law of art development. That is, it seems a clear case of the normal conversion of naturalism into conventionalism or, in more specific terms, pure art giving rise to applied art. Viewed in this light one is tempted to regard it as an illustration of pictorial art, originated and developed by men, giving way to decorative art, practiced mostly by women. One might also argue with some show of reason that the so-called degeneration was more apparent than real because due to inherent necessity. The explanation is this. When the free-hand portrait art, executed on large cave-wall spaces by the early nomadic hunters, was applied by the later sedentary agriculturists to the small surfaces of basketry and textiles, under the limiting conditions imposed by weaving, the naturally flowing outlines of the animals depicted had to be sacrificed for results that were angular and more or less geometric.

But, unfortunately, while both of these suggestions must be given some weight, the fact remains that women were not the original creators of stylized symbols and geometric patterns, for these appear at an early date as the work of men in the caves alongside the pictorial representations, where they were not the result of necessity. Also, though it is true that some of the geometric conventionalizations, once achieved on textiles, were reproduced on the cave walls and later copied on pottery, pottery surfaces, though small, lent themselves as easily to pictorial representations as did the cave walls. Moreover, elsewhere in the world, as for example in our own Southwest, animal pictures of admittedly inferior character were executed on both cliff walls and pottery throughout most of the Neolithic Age. In Europe, however, this was not the case in any true sense, though here mural art was eventually revived in degenerated form during the Bronze and Iron ages and in the natural course of artistic development improved for distinctly decorative purposes throughout historic times.

A survival

We must conclude, therefore, that pictorial art of the strictly Paleolithic style disappeared from southwestern Europe as a natural result of the decadence of the hunting cultures during Mesolithic times, i.e., actually some time before the dawn of the true Neolithic Age, or about ten thousand years ago. In northern Europe the tradition lingered on for a considerable time, while in Africa it flourished without marked change almost to the present day.

Having indicated the historical position of Old World pictorial art, let us next take a swift look at its contents. The various products of the whole endeavor fall into two grand divisions: stationary art and portable art. By stationary art is meant simply human and animal representations painted, etched or sculptured on cave or cliff walls and therefore permanently fixed. Belonging to this group are also a few examples of clay modeling, similarly immovable and which therefore, like the mural creations, were in a sense public property for everyone to see. Portable art, on the other hand, comprises small objects of all sorts carved in or engraved upon pieces of stone, bone, ivory, antler, shell or wood and which could have been moved about and owned as personal possessions. Both of these art manifestitations, fixed and movable, as well as beads, pendants and other forms of bodily adornment, make their first appearance in Europe with the coming of the so-called Cromagnon man. But where precisely the Cromagnon man came from is still a mystery. Possibly it was North Africa; though, if so, it is strange that he appears to have left there next to no remains of portable art objects. Only stationary art is at all well represented here and the same is true, as far as present knowledge goes, for all the rest of prehistoric Africa.

Characteristics of South African pictures

As would be expected, all the earliest artistic efforts were crude. In Europe mural representations of animals, though the subjects must have been very familiar to the artists, began as amateurish profile outline drawings, either deeply incised or painted in a single color—red, brown or black. Depth or perspective was lacking, the animal depicted showing usually only one fore leg and one hind leg. In time this was remedied, with distinctly lifelike results; and in addition full-bodied representations appear, the enclosed contours being stippled, scraped or painted all over, the last process yielding monochrome silhouettes. Finally, the painted monochromes developed into variously shaded polychromes and the etchings or engravings reached a fair degree of excellence as high relief sculptures. This, however, was the course of progress in Europe only, and with that in mind let us turn finally to a brief consideration of corresponding art as practiced in South Africa.

In Africa the earliest examples of mural art are not so easily identified as in Europe. Perhaps the sequence is not complete because the pictures here were executed not in deep sheltering caves but in open rockshelters and the oldest may long since have weathered away. Also it is possible that the art having been introduced, at least in the south, in developed form, the preliminary stage never existed. But, as may be seen in the accompanying illustrations, pecked (sometimes incised) outline and full-bodied pictures are present, as are also both monochrome and polychrome paintings. The mineral colors employed were varying shades of red and brown, also white, black, and on rare occasions yellow and blue. The colors used do not as a rule correspond to the colors of the animals depicted but are arbitrary; and in the case of polychromes the different hues employed for different body portions meet abruptly without intermediate shadings. Some students are of the opinion that the prevailing colors varied from time to time and that in this way some four or five sequential stages may be distinguished. Thus the first or oldest pictures are thought to be monochromes in reds and yellows, the second series are in deep reds and browns, the third in light red, the fourth polychromes of various hues, and the fifth and last simple blacks and whites. Other investigators present the order of succession in more general terms: monochromes, polychromes, and a final series showing a marked decline.

Concerning the essential characteristics of the art as art, i.e., as to drawing, perspective, composition, rhythm and so on, little can be said here. Technique and style are there, but the illustrations must be left to speak for themselves. As may be seen, the outstanding features are realistic. Conventional symbols, idols, and fabulous creatures are either rare or absent. In this respect the art, although certainly affecting a unique, almost modernistic flair, comes much closer to the natural model than does the art of the African negro. Here is depicted, as a rule, only the realities of daily experience: animals running, grazing, falling or lying down; also men hunting or dancing, with and without disguise; and occasionally men in council and in procession. The pictures must, in short, be attributed to a people of essentially the same mentality or cultural status as the Paleolithic hunters of Europe. And these people are by common consent supposed to be the slowly vanishing Bushmen.

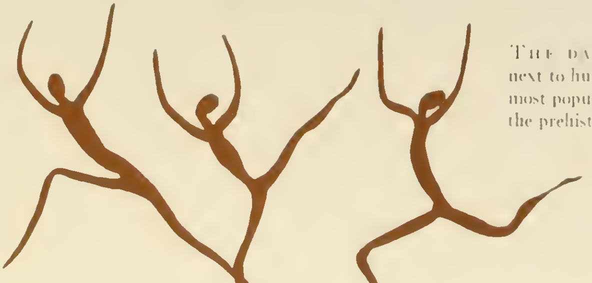
Age of the South African pictures

Everyone will ask: How old are these South African art treasures? The answer is, no one knows precisely. It is generally agreed, however, that the most ancient may be several thousand years old and it is definitely known that the latest were made by the Bushmen as recently as seventy-five years ago. But the Bushmen were not the first inhabitants of South Africa and so it is possible that some of the oldest rock pictures may antedate their coming and are to be credited to another people. In either case it is reasonably certain that the South African pictures were made by a people who, as in Upper Paleolithic times in Europe, made specialized implements adapted from flint flakes and not, as in earlier days, crude generalized implements improvised from cores.

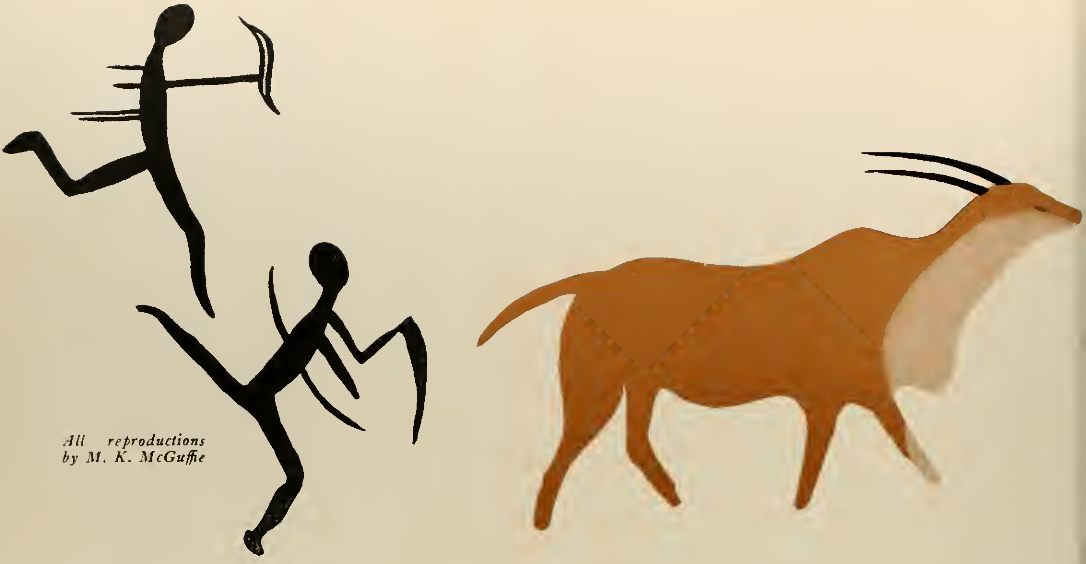
Significance of rock pictures

In conclusion, a few remarks must be ventured about the meaning and purpose of the rock pictures in South Africa and elsewhere. As the reader must already suspect, the question, long under dispute, remains largely unanswered. Surviving primitive peoples seldom have any explanations to offer and the opinions of students differ widely. Some have held that most of the inscriptions were the work of idle hours and as such have no more profound meaning than the improvisations made by modern boys and girls on the fence and sidewalk; that, in short, they merely satisfied an innate craving for expression. Others claim that we have something more than that, in fact purposeful art for art's sake. Still others —and these are in the majority—have invested the pictures with a religious or magical purpose. Thus they claim, and with good reason, that the animal pictures, for instance, were part of an incantation process carried out to ensure success in hunting the real animals. Such ceremonies have actually been witnessed in Africa, where natives before going on a hunt first drew on the ground a picture of the animal wanted and then while mumbling incantations over it shot arrows into the picture—a form of well-known sympathetic magic. Some of the compositions actually depict hunting and dancing scenes, both of which may well have had magical purposes. Others may have illustrated mythological conceptions or may have recorded important events in tribal history.

We can follow the fascinating subject no farther. Probably all the above suggestions have to be taken into account. The peoples who made the ancient pictures were not so very different from ourselves and we may safely assume that their artistic achievements served much the same purposes as our own. Art is an essential function of life, explain it how we may.

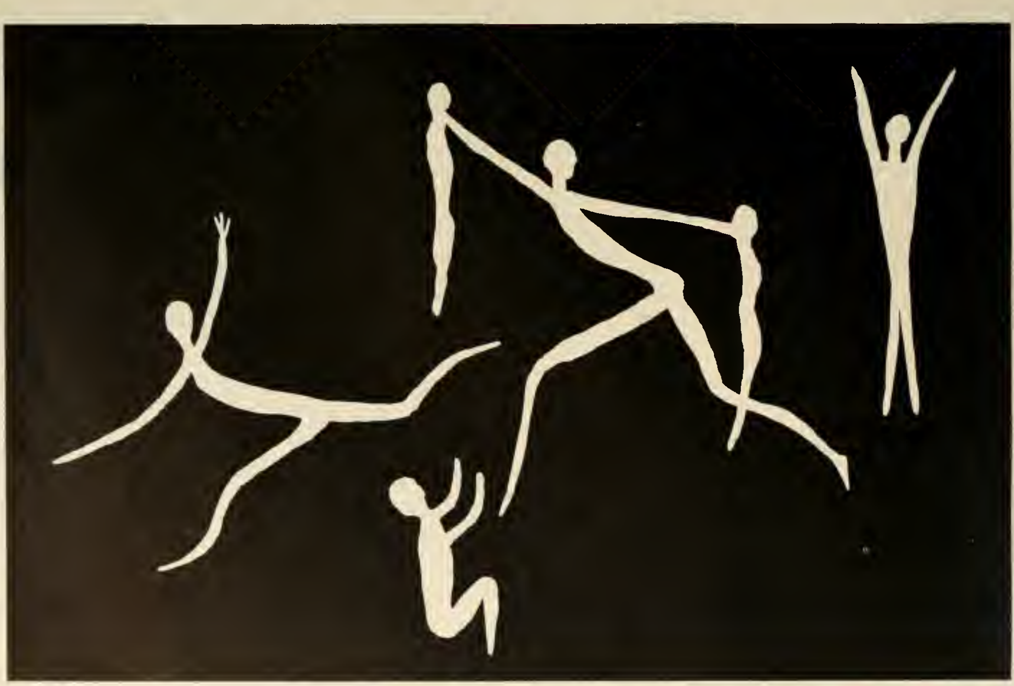


THE DANCE, which next to hunting was the most popular subject of the prehistoric artist

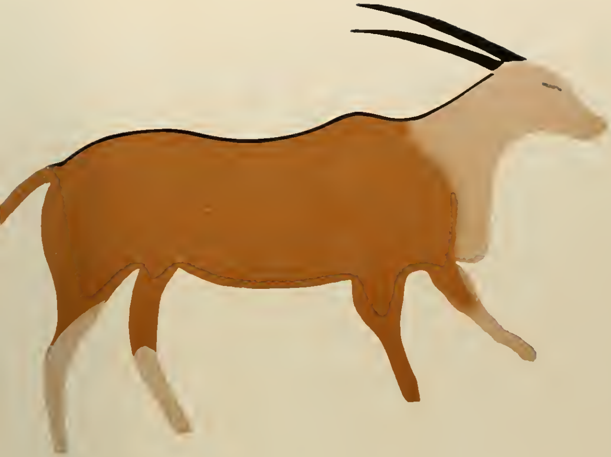


All reproductions by M. K. McGuffie

(Above) THE CHASE: two elands pursued by a pair of hunters. The streaks at rear of the upper figure represent arrows; in front of him is a badly drawn bow. Compare the tail of the central eland with the one at right: the lower human figure is believed to have just chopped off the end of it with the weapon in his hand, probably a stone axe. This hunter carries his bow slung across his body

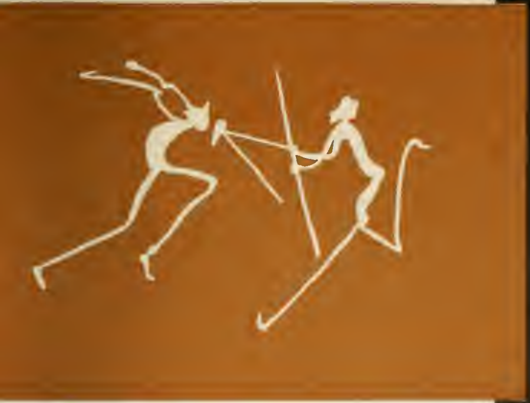


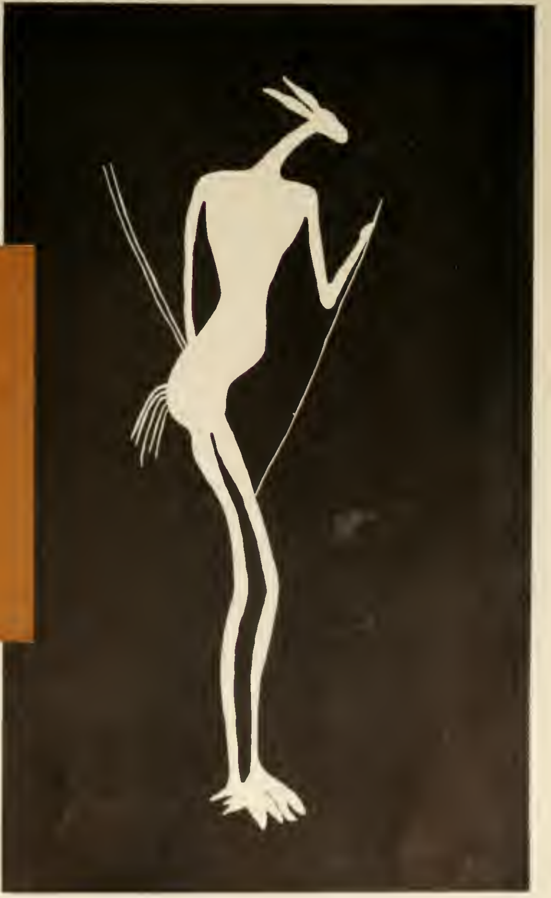
(Above) THE PRANK: a boy with two puff-adders scaring his companions. Notice how the primitive artist expresses flight and abject terror with the greatest economy of detail, a technique copied by many modern artists. The rock gallery where this picture was found is near a river infested with snakes, which form quite an important part of the modern Bushman's food. The latest of these South African art treasures were made as recently as 75 years ago by the Bushmen; the most ancient may be several thousand years old and denote a mentality and cultural status similar to that of the Paleolithic hunters of Europe



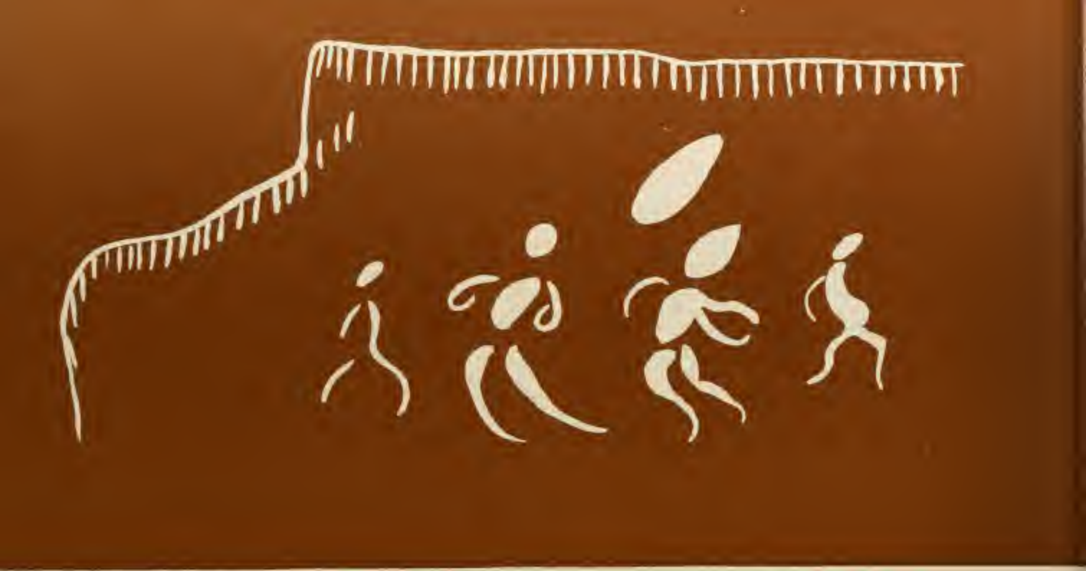
Two broad types are distinguished in the primitive rock pictures widely distributed over Africa and Europe: (1) "portrait pictures" representing single animals or human beings, mostly in varied colors and relatively large in scale (Franco-Cantabrian type); and (2) "action pictures" of groups illustrating for the most part hunting and dancing scenes, usually in monochrome and small in scale (Levantine or Eastern type). The South African pictures are definitely "action pictures" (though not always in monochrome), and are in the tradition of the Paleolithic style which disappeared from southwestern Europe about 10,000 years ago. They present an almost modernistic flair in their freedom, realism and absence of conventionalized symbols

(Below) THE FIGHT: a battle between two Mantis-Men, or Kaggan. Symbolizing the courage and combative nature of the insect known as the praying mantis, the Mantis-Man is regarded by the Bushmen as a spirit of mischief and is a favorite subject of the rock painters of old. In this grotesque picture, conveying a sense of fierce action, the weapons so vigorously wielded seem to be a wooden club, hook, spear and stone-headed axe



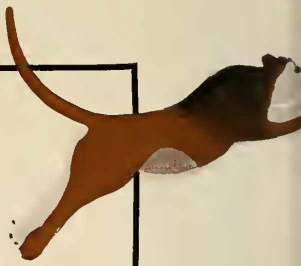


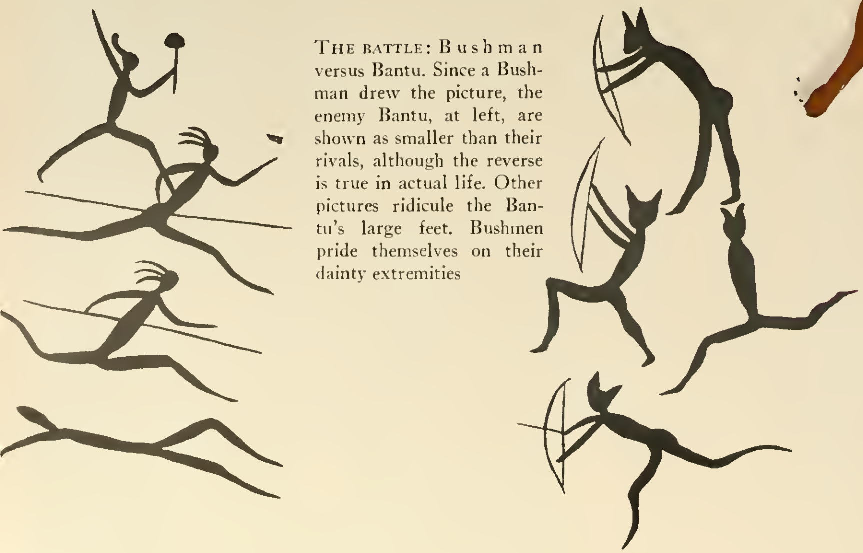
(Right) THE MANTIS-MAN: a mythical creature apparently important in the spiritual philosophy of the ancient artists. As in this example it is frequently presented as a hunter wearing a buck's head-mask and always with long thin legs. Today the mantis is referred to as the "Hottentot god," and when one alights on a Bushman he will sit perfectly still until it flies away



(Above) THE RAIN-MAKERS: an ancient depiction of a ceremony for bringing rain. Legend has it that the "Rain Bull" and the "She Rain" (mythical animals) were led to an appointed place by the witch doctor of a Bushman clan, and there slain so that the rain might descend and produce the plant-life on which the Bushmen depended for food. This painting shows evidence of being extremely old

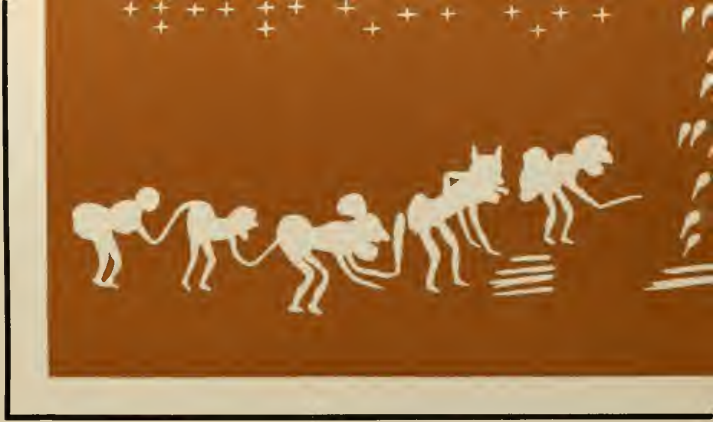
(Below at right) THE CHARGE: a black-maned lion pursuing a group of fleeing men. In the original picture, a veil-like film of black has been traced over the yellow ochre of the lion's shoulders, apparently intentionally as it cannot be accounted for by rock exudation. This latter phenomenon is effacing many of the pictures in this particular gallery, and total disappearance is only a matter of time

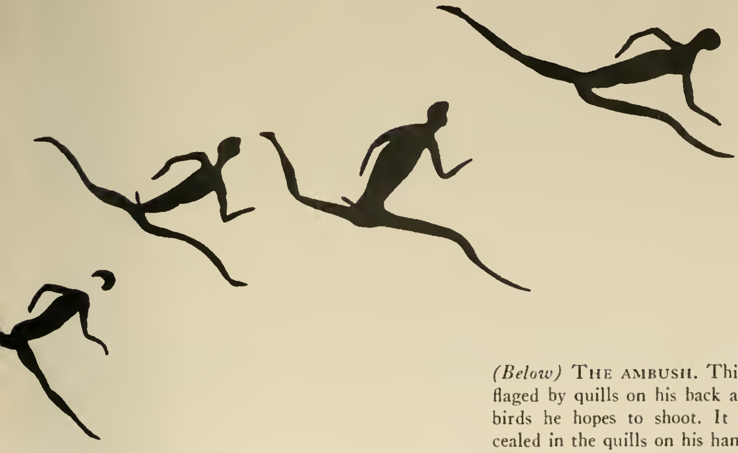




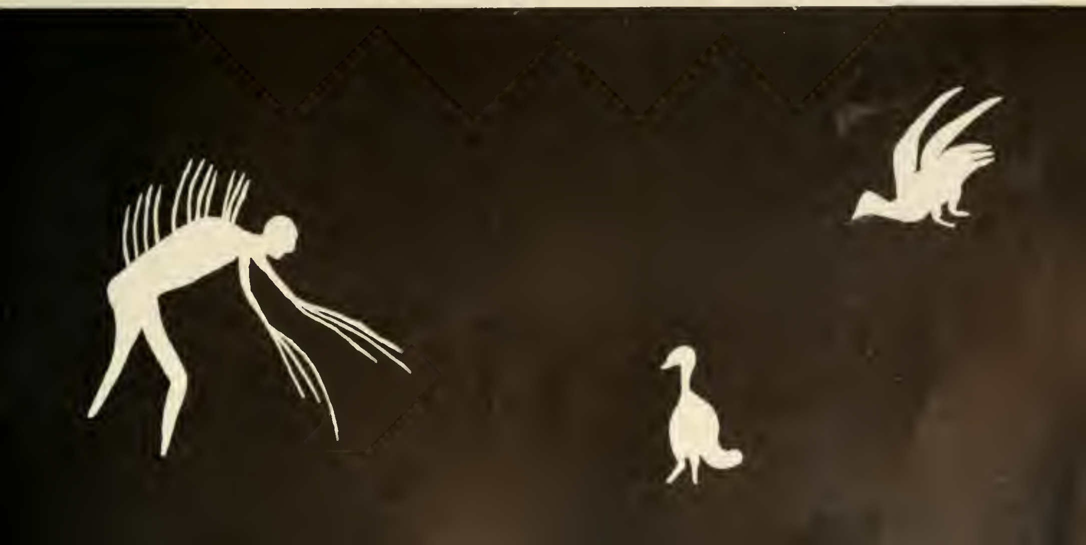
THE BATTLE: Bushman versus Bantu. Since a Bushman drew the picture, the enemy Bantu, at left, are shown as smaller than their rivals, although the reverse is true in actual life. Other pictures ridicule the Bantu's large feet. Bushmen pride themselves on their dainty extremities

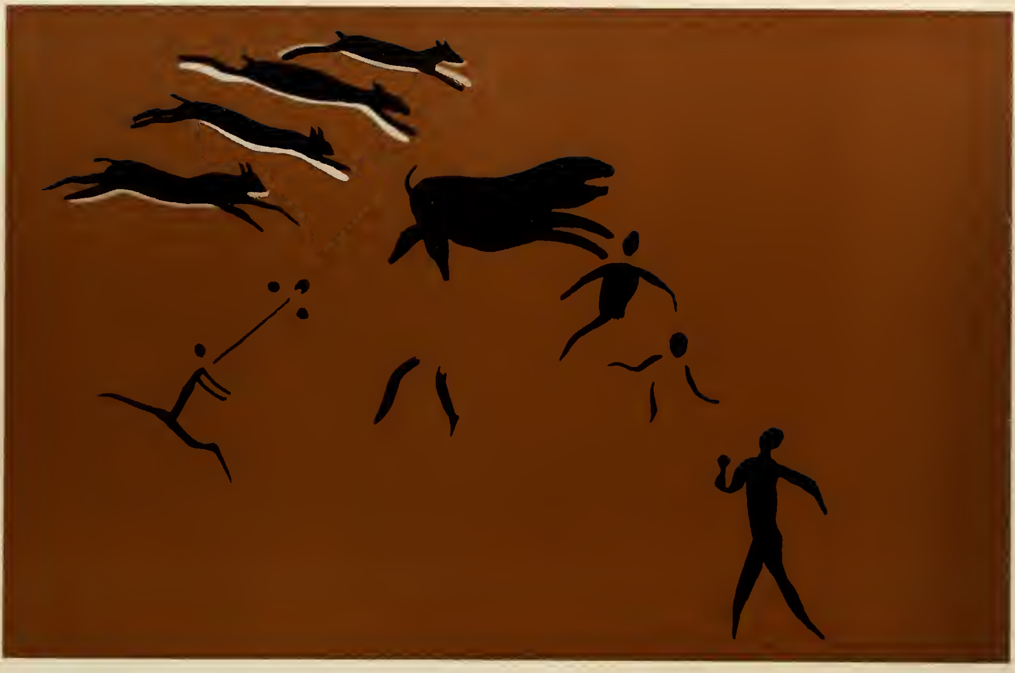
(Right) THE RITUAL: a picture probably intended to represent a nocturnal ceremony as indicated by the artists having chosen a poor surface of dark rock for it instead of better mural surfaces above and below. The crosses at top are stars, the pear-shaped objects at right are flames or sparks of a fire rising from horizontal faggots. Ostrich plumes and animal heads appear to be part of the ornamentation of the weird figures





(Below) THE AMBUSH. This picture shows a hunter, camouflaged by quills on his back and hands, stealing up on the two birds he hopes to shoot. It is possible that arrows are concealed in the quills on his hands. This species of ground bird is called the Kornhaan (pronounced Koraan), is excellent food and is now protected by law

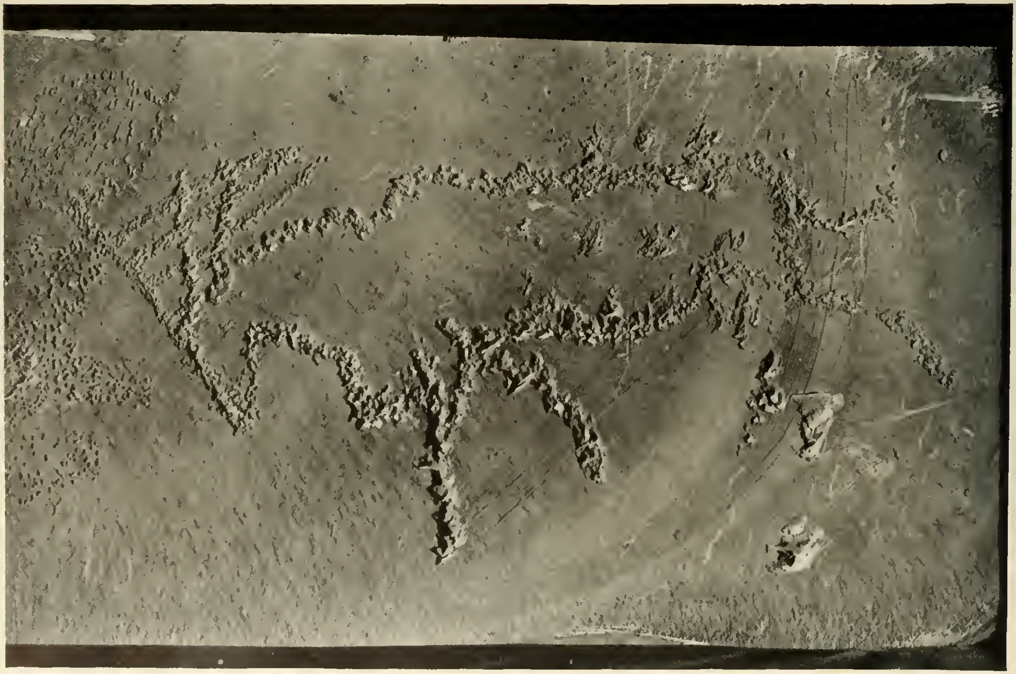




(Above) THE WILD-PIG HUNT: a scene which like many others is believed to be part of an incantation process to insure success in hunting. The dogs at upper left are apparently aiding in the chase. The sling-like weapon is judged to consist of three perforated stones on separate strands

(Below) AN ELAND pecked in rock: an example of the primitive rock engravings, which extend over a wide area in South Africa. Although geographically they do not overlap the paintings, both are believed to be the work of the same people, the ancestors of the present Bushmen

Photo A.M.N.H. and Charles H. Coles



14th CENTURY B. C.

A REIGNING BEAUTY of Egypt who painted her nails red over 3000 years ago: Tut-ankh-amen's mother-in-law, Queen Nefertiti

Reproduced through the courtesy of the Metropolitan Museum of Art

THE ANCIENT ART OF BEAUTIFICATION

Showing that beauty salons are as old as civilization and that the painting of one's face is one of the earliest and most highly specialized arts

By VIRGINIA S. EIFERT

TODAY'S styles in cosmetics will probably look old-fashioned in ten years, and we are apt to think of the lively art of beautification as one of life's most up-to-date phases. But adornment of the flesh is almost as ancient as the human race and what appears to be the newest fashion may be one of the oldest.

Queen Nefertiti, a reigning beauty of Egypt 3000 years ago, painted her fingernails and toenails red. And in a tomb built more than 5000 years ago near Ur in Sumeria was found a blue-green malachite compact and a tiny filigree gold vanity case belonging to Queen Shub-ad which might have been purchased today by a modern woman of discrimination. The vanity case, no larger than a man's little finger and shaped like a shell, contained a small spoon, probably for use in scooping rouge, a metal stick for training the cuticle, and a pair of dainty tweezers for shaping the eyebrows.

Manners change from decade to decade, and morals fluctuate with the reigning spirit of time, but cosmetics are among the oldest human inventions.

Lying between the Tigris and the Euphrates, Sumeria with its highly civilized cities of Susa, Ur, Lagash, Erech, and Eridu, flourished in the midst of an uncivilized wilderness long before Egypt to the west had developed her distinctive culture, or Babylon had built her temples. Savages surrounded Sumeria, and south of Egypt lay the savage continent of Africa. In the African jungles and on the sun-baked veldt lived the black men and women whose lives have been virtually unchanged throughout the centuries which saw the rise and fall of Sumeria, Babylon, Egypt, Assyria, Persia, Greece, and Rome. They were little changed when Stanley entered Africa. They are little changed today. Unchanged also are their cosmetics and their methods of adornment. Six thousand years are as nothing when a woman wants to paint her face.

To war or to woo

Possibly it was the men who first painted their faces and adorned their bodies in a fearful and remarkable manner. In the beginning perhaps they only greased their skins to keep them supple in the dry winds and harsh weather to which they were constantly subjected. Although grease made the skin shiny, it was not enough when man finally began to think about adorning himself. This first artificial coloring of the body to attract women and frighten enemies was probably man's first attempt at art.

In Africa, where both men and women painted themselves for an unknown number of centuries, cosmetic styles differed with each tribe. Strange indeed, to our tastes, were their notions of beauty. In central Africa the Fellatah women wrapped their fingers and toes with henna leaves to make them a gorgeous purple; they colored their hair with indigo, stained their teeth alternately with blue, yellow, and purple; and they pencilled their eyelids with sulphuret of antimony.

South of the land of colored teeth and blue hair lies the Kaffir country. To those who know Africa, the Kaffir country means red clay. It is an integral part of the land, of the people, and of their dress, for among the Kaffirs, red clay is a cosmetic without which life would not be complete. This clay, a red ochre, is combined with oil and is rubbed into the skin as a protection from sun and rain. The skin, being naturally an ashy or slate-grey color, is thus changed to a rich chocolate brown. Oil and clay are even rubbed into the hair. And so, because the Kaffir land is all red clay, and the kraals are of red clay, and the people are covered with oil and red clay, there is formed an interchangeable scene which a short distance away appears to be nothing but red clay.

Throughout the rest of Africa, cosmetic whims change with the miles. The Hottentot women, to make themselves beautiful in the eyes of their men, rub their bodies with butter, soot, and the lemon-scented leaves of the buchu bush, a shrub of the Rue or citrus family. In another place—perhaps just across the veldt—native beauticians plaster butter and dung into the hair in order to build up a remarkable and ill-smelling structure.

Most African tribes, in addition to painting themselves, practice a crude form of tattooing or scarring, known as cicatrization. Gashes made in the skin are filled with clay to make raised scars which have a traditional esteem among these people quite as high as face paints. Although the pigmy women of the Kalahari Desert tribes liked to paint their bodies spirally with antelope blood, among the majority of the African tribes white paint was most popular, probably because it contrasted so well with the African complexion. With antelope blood on the body and a sparkling blue mineral powder made of mica-schist on the hair you have a combination that certainly bears out the contention that Africa is a land of extremes.

Wild men with compacts

While in Africa both sexes painted their faces, in certain parts of Australia the men monopolized the use of cosmetics. The women were allowed to paint their faces, but it was a great offense to paint their necks and bodies. Braves carried compacts containing red, yellow, and white paint with which to retouch their decorated skins. On ordinary days a few spots of color were enough—just a dab of red, yellow, or white on cheeks, shoulders and breasts. But on feast days and special occasions, the Australian native felt shamefully naked unless his entire body was painted.

In the New Hebrides in the South Seas, braves and medicine men also carried make-up boxes containing yellow ochre, coral lime, and purple ashes, the latter probably obtained from burned coconut shells. During head-hunting dances, the men painted themselves from head to foot with bright yellow ochre, leaving large circles of dark skin around eyes, nose, and mouth. When traders came to the South Sea islands, the most highly valued objects they could trade to the natives were white lead, calcimine, red paint, and common bluing. Throughout the centuries before the coming of white traders, however, the savages had to be content with clay colors, chalk, and dyes derived from leaves, for use in the intricate process of painting themselves.

The women in New Zealand seem to have had their full share of cosmetics, for when Captain Cook visited the islands he noticed that his sailors, on returning from shore-leave, came back with red or yellow noses and spots of color lurking elsewhere on their persons—markings which had been borrowed intentionally or unintentionally from the heavily painted native sirens.

Throughout the South Sea islands, however, it was not paint but tattooing which had the most esteem as personal decoration. More durable than paint, it was a sign of manhood and virility in men and fortitude in women.

An ordeal

The word tattoo itself is of Polynesian origin, from the Tahitian word *tatu,* meaning "mark." Blue paint, made by mixing the ashes of coconut with water, was introduced into the skin by repeated punctures made with sharp instruments of human bone, while the writhing patient was held down by interested women of the tribe, who shouted and sang to drown any cries he might make. An outcry, however, was greeted with taunts and mockery, for it indicated a poor spirit and lack of manhood.

As Darwin observed, "Not one great country can be named . . . in which the aborigines do not tattoo themselves." Religious and social significance is often attached to tattooing, but the motive of adornment is generally a strong one. In East Africa, for instance, although the patterns distinguish different tribes, tattooing is chiefly for beautification. Some of the most elegant work is done in Japan and Borneo, and the Maoris of New Zealand are noted for their elaborate swirling facial designs, which are said to conceal a person's age, causing the old to look young and the young old. A funnel has to be used to feed a Maori chief while his face is being tattooed, for the inflammation makes it impossible to move the jaws. The tattooing of the Haida Indians off the coast of British Columbia is probably the most finely wrought in the Americas.

Tattooing was popular among the Mayans and Itzas of Mexico and was carried to a high degree of artistry. All sorts of circular designs and writhing animals and mythical figures were pricked in the skins of the ancient Mexicans. These people also smeared their faces and bodies with greasy and odoriferous substances, and painted themselves. Some filed their teeth to points, while other drilled holes in them and filled them with bits of jade and turquoise.

North of the Mexican border, the aborginal American Indians developed to a great extent the art of body painting, together with the knowledge of dyes and pigments. The use of iron salts in conjunction with vegetable extracts produced fast colors which were applied on a base of deer grease or bear grease. Decayed hematite ore, or iron oxide, when mixed with grease, made a red-brown rouge—a rouge which was well-nigh indelible if applied without the fat. For special dances and war preparations, the braves usually painted the entire body. In the southwest, the Moqui snake-dancers even today paint their faces black as far as the mouth, white from the mouth to the neck, and dark red from the neck to the heels. The Indians lubricated the entire body to serve as a ground for paint, as well as a protection against the weather. Animal fat so used was a sort of cold cream, which, although not invented in Europe until the first century after Christ, was probably used among the North American Indians much earlier. Cold cream, in a different form, had been used among the ancients of Asia and Africa since the beginnings of civilizations on the Tigris, the Euphrates, and the Nile.

Hundreds of years after the compact of Queen Shub-ad of Ur was buried with the beautiful queen's mortal remains, the great civilization of Egypt developed and with it rose the art of personal adornment. As early as the First Dynasty—about 3500 B. C.—toilet articles and unguents were placed in the Egyptian tombs. No one knows how long before that cosmetics were used in Egypt, possibly as early as 5000 B. C.

Priests were perfumers

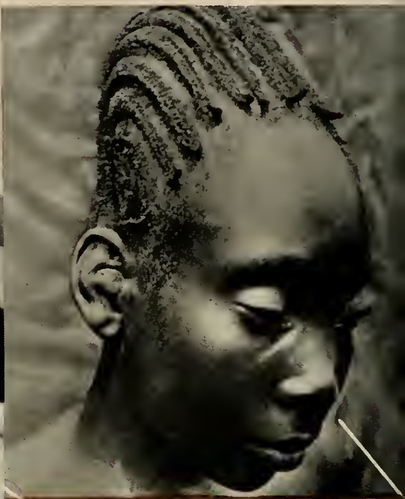
Until comparatively recently, the art of making and mixing cosmetics was an obscure and mysterious secret which was revealed only to a chosen few. In Egypt the priests made the compounds and were the perfumers of the time. This pursuit was considered to be a high and most worthy art and was patronized by the wealthy, who alone could afford cosmetics and the services which went with them.

Cosmetics came under eight headings: unguents; perfumes; creams; pomades; rouges; powders; eye-paint; and nail-paint. Unguents were lubricating fats and oils; perfumes were very important—each part of the body should have its own particular scent. Pomades were thick, fatty colors which were used to color the nails, breasts, and often the hair. Powders apparently were scarce in Egypt, but eye-paint probably was the most popular of all the cosmetics.

DISFIGURATIONS IN THE

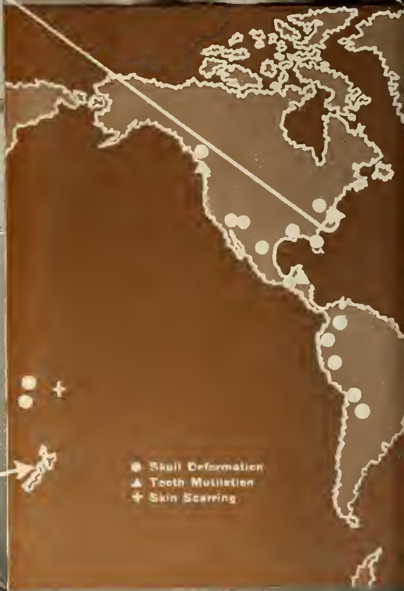
Head *(Right)* Deformation of the skull as practiced in central Africa: a widely distributed custom as indicated by the symbol●. The methods employed vary from cradleboards and bandages to elaborate mechanisms of diabolical appearance. The deformation seems to have no noticeable effect on intelligence. Of the European instances most are ancient, though in France and Holland deformation occurs accidentally in modern times as a result of coiffure

Ewing Galloway



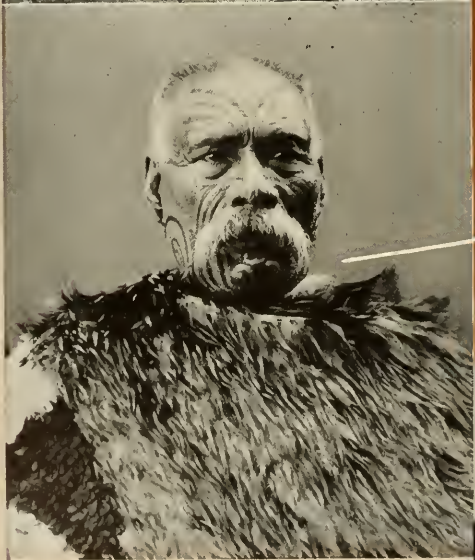
Waist *(Right)* Deformations are not restricted to backward peoples. In our own country and certain parts of Europe visitors from less civilized parts of the world not many years ago might have been startled at the fashion among women of tightly constricting their waists, a practice scarcely less extreme or less dangerous to health than some of the other examples on these pages

Brown Bros.



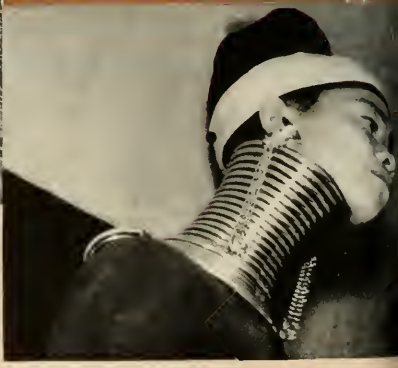
Ewing Galloway

Face *(Right)* The typical facial tattooing of a Maori chief of New Zealand is a classic example of the elaborate and artistic development of tattooing among primitive people. Tattooing has been practiced by the aborigines of practically every country in the world. Though it is often endowed with social and religious significance, it is generally regarded as a definite enhancement of beauty

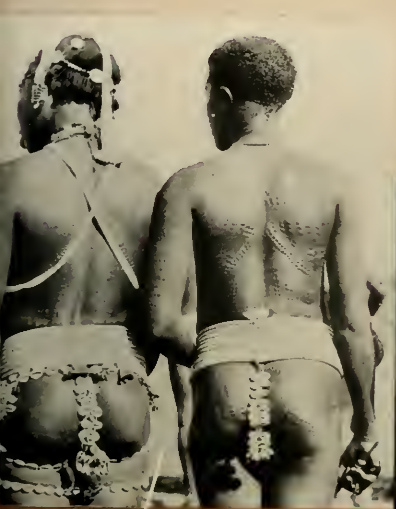


Neck *(Right)* The giraffe-necked women of Burma display a fashion that is found also in parts of Africa. The ornamental collar is gradually heightened by the addition of successive rings, but the effect is more the depressing of the shoulders than actual lengthening of the neck

Keystone View Co.

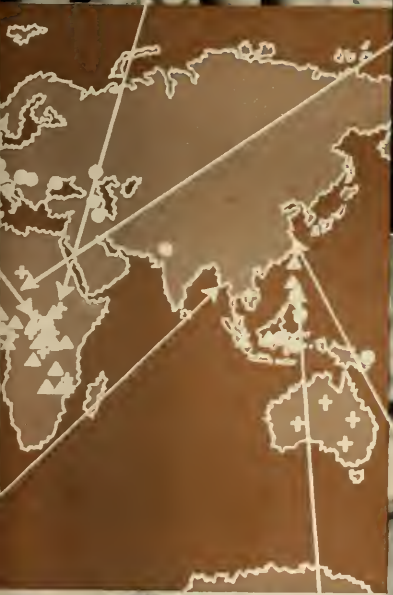


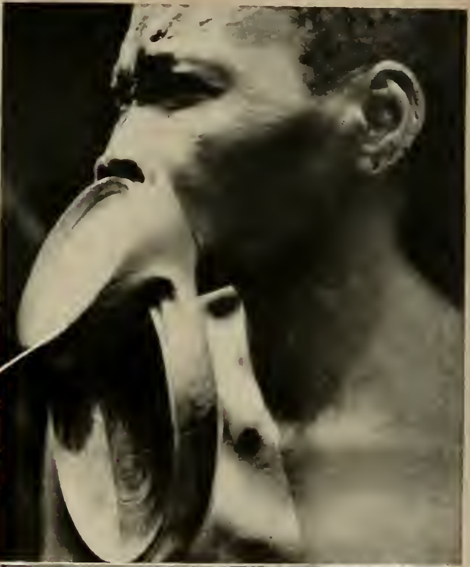
NAME OF BEAUTY



BODY *(Left)* Skin-scarring, or cicatrization, is practiced as a mark of beauty or a tribal distinction chiefly by the dark-skinned peoples of Africa and Australia, on whom tattooing would be scarcely noticeable. The scars, sometimes over a quarter of an inch high, are produced by keeping cuts open for weeks or months by irritating substances. This photograph comes from above the White Nile; other localities are indicated by the symbol +

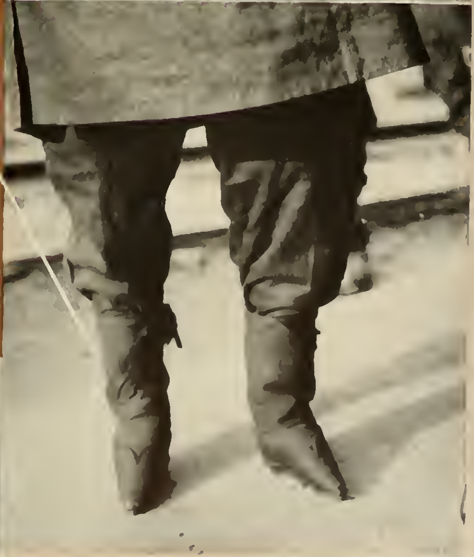
Black Star





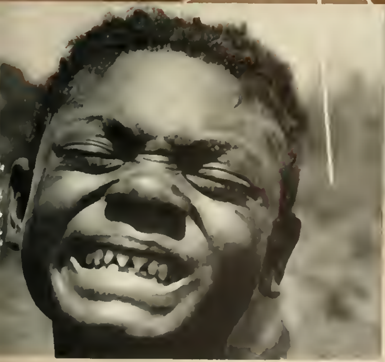
LIPS *(Left)* The "duck-billed" women of various African tribes represent the extreme in lip embellishment. The circumference of the distorted lip sometimes exceeds 29 inches. The disk is uncomfortable and hampers eating, but it can be removed. Less conspicuous lip rings and plugs are worn so widely that their distribution cannot well be shown on the accompanying map

Black Star



Ewing Galloway

FEET *(Left)* The bound feet of the Chinese, though now rarely seen, are a well-known example of deformation in the name of beauty, and were long regarded with revulsion by the western world. Though they are scarcely more flagrant a violation of orthopedic science than were the constricted waists of a generation ago, their odium was based partly on the fact that helpless children were the victims

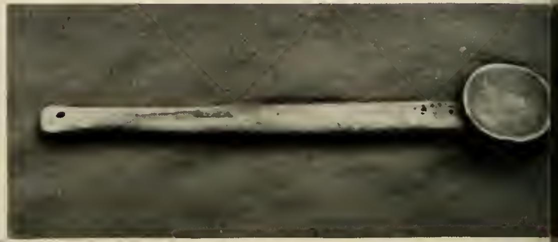


TEETH are filed by the Negritos of Luzon, Philippine Islands, as shown above, and elsewhere in the Malayan region, but the chief area where this fashion reigns is in tropical Africa. Some of the localities where tooth filing and other forms of tooth mutilation have been observed are represented on the map by the symbol ▲

Ewing Galloway

ART OF BEAUTIFICATION IN

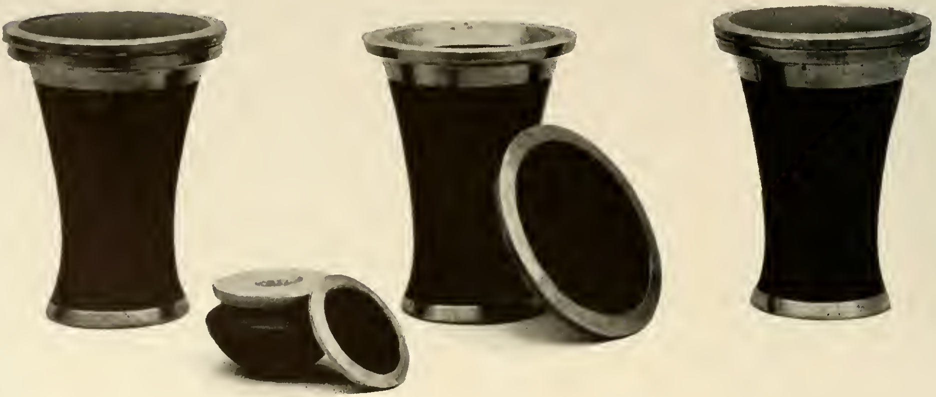
THOUGH STYLES in cosmetics are generally regarded as one of life's most up-to-date phases, some of the newest fashions are among the oldest. The queens of Egypt painted their finger-nails and toe-nails red, the Romans took milk baths, and the Greeks tried hard to become a race of platinum blonds. On these pages are shown some of the beauty aids and toilet articles used by the people of these three ancient civilizations



(Above) A SMALL IVORY SPOON used for cosmetics before the Pyramids of Egypt were built. As early as the First Dynasty (about 3500 B. C.), from which this spoon comes down to us, toilet articles and unguents were place in Egyptian tombs. No one knows how long before that cosmetics were used in Egypt, possibly as early as 5000 B. C.

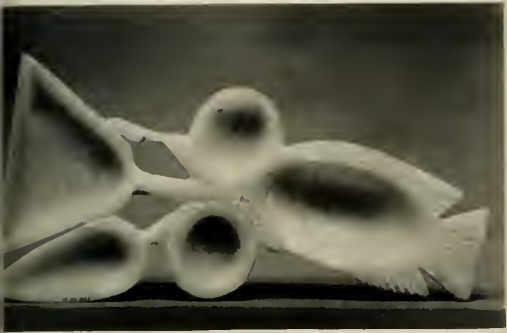
(Left) ONE OF THE EARLIEST BEAUTY AIDS FOUND; a little slate palette in the shape of a bird used for mixing cosmetics. (Egyptian, of Pre-Dynastic origin)

All photographs by the courtesy of the Metropolitan Museum of Art

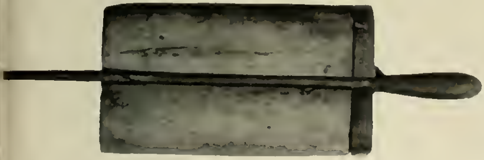


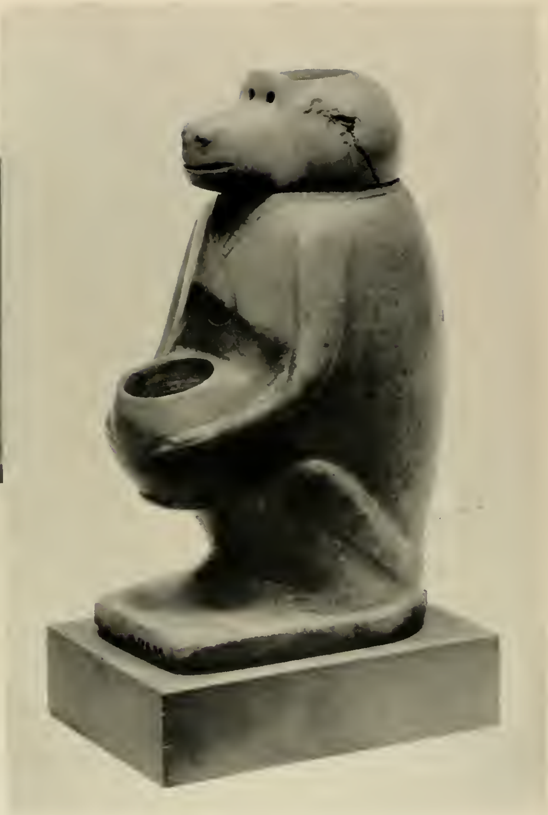
(Above) COSMETIC JARS of an Egyptian princess who died over 3700 years ago: three polished obsidian vases mounted with gold for creams, rouges and beauty oils; and a small pot for kohl, a black substance used extensively as eye-brow paint. The objects were found in the tomb of Princess Sat-hathor-inunt

ANCIENT EGYPT



(Above) AN ALABASTER COSMETIC DISH in fish and lotus blossom design, from the 15th century B. C. The priests of ancient Egypt compounded the cosmetics and were the perfumers of the time

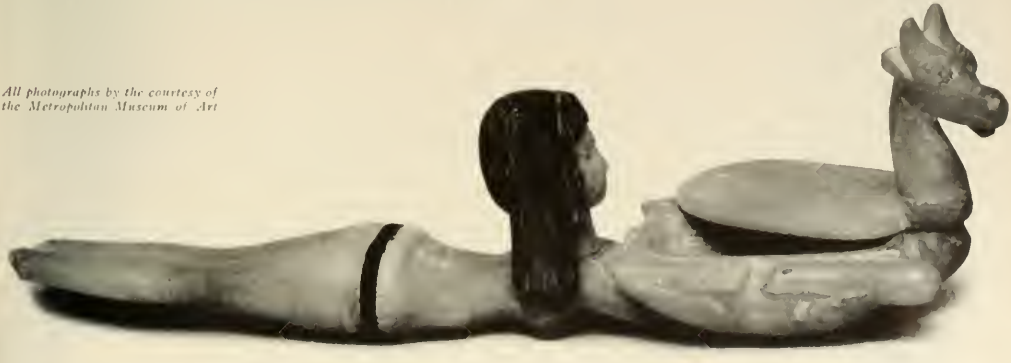




(Above) FROM A ROYAL COSMETIC SET: an ebony eye-paint container, as indicated by traces of powdered antimony or kohl found in it, identified with Nefru-re (1580-1350 B. C.). The paint was applied with the stick and was one of the most popular cosmetics in Egypt

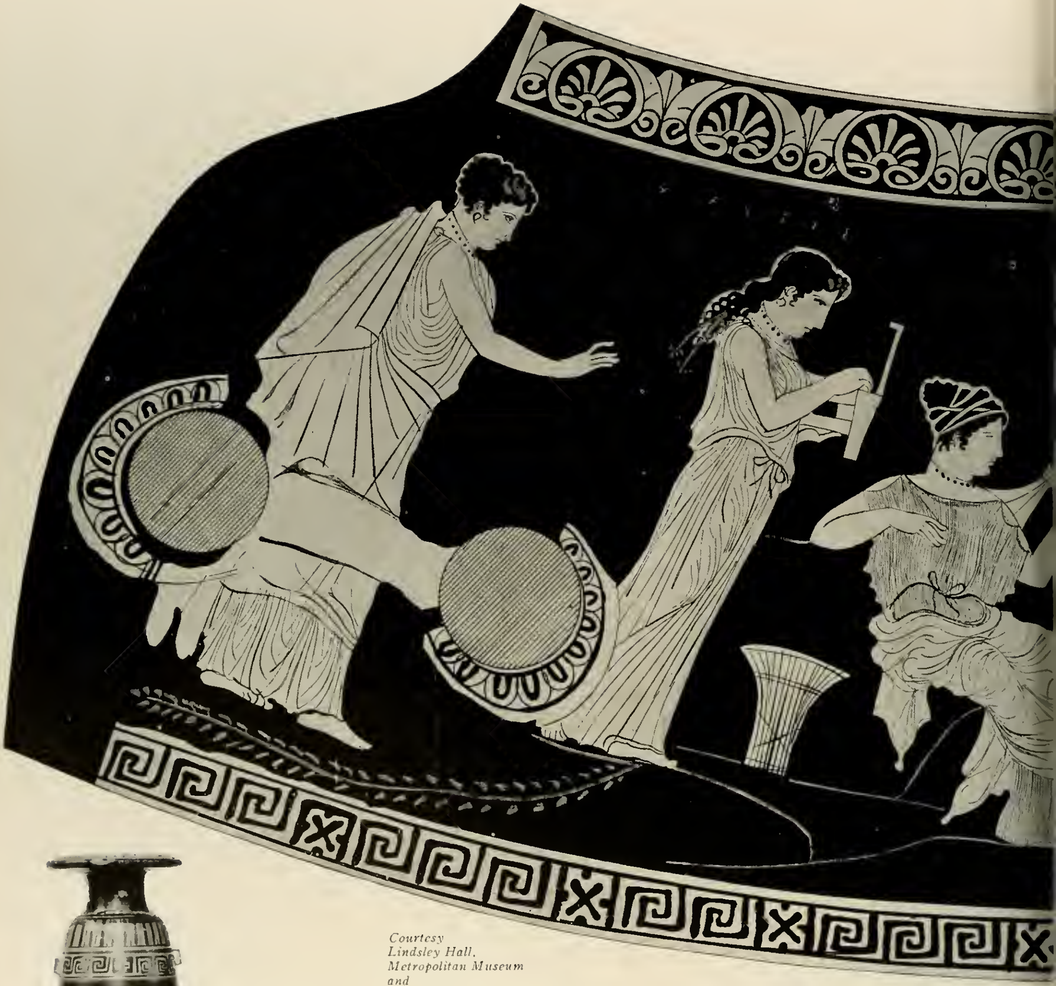
(Above) A BLUE-VEINED TOILET JAR of the XII Dynasty. Containing probably a sort of cold cream, this jar is like that found in the tomb of Tut-ankh-amen which gave out a fragrant odor when opened by excavators over 32 centuries later

All photographs by the courtesy of the Metropolitan Museum of Art



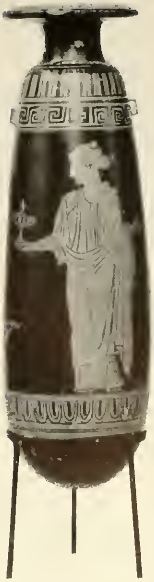
(Above) PROBABLY USED TO SCOOP ROUGE from cosmetic pots, to stir lotions, and to mix creams for royal complexions some 34 centuries ago: a covered cosmetic spoon of alabaster and slate carved in the form of a young girl swimming after a gazelle.

Those who could afford it sometimes had seven different creams and two kinds of rouge buried with them for use in the after life



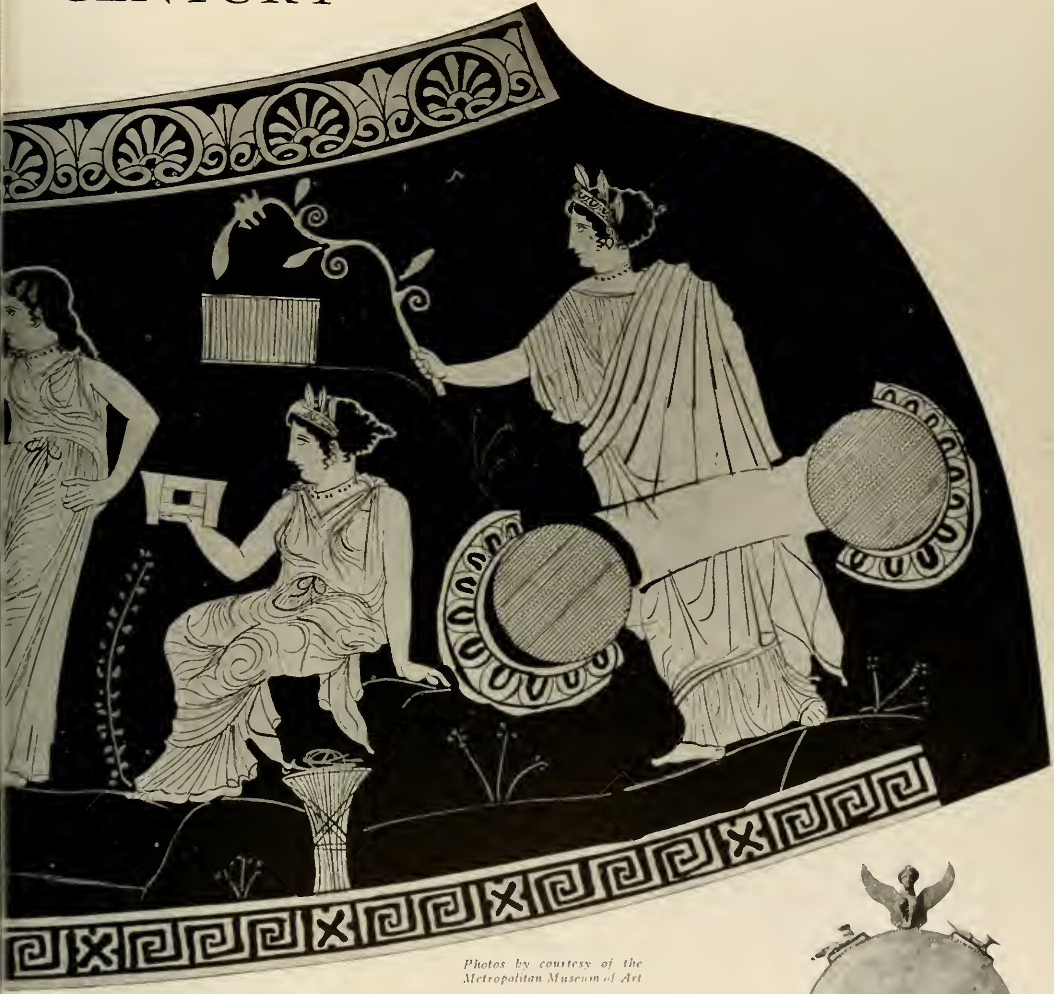
Courtesy Lindsley Hall, Metropolitan Museum and Yale University Press

DETAIL FROM A GREEK VASE (420-410 B. C.) showing an outdoor scene of women engaged in the characteristic pursuits of the time. Two baskets containing wool are on the ground, but no one is working. Rather the women are more interested in looking in the mirror and arranging their costumes. One is using a toilet case containing the cosmetics which figure prominently in the life of the women of ancient Greece



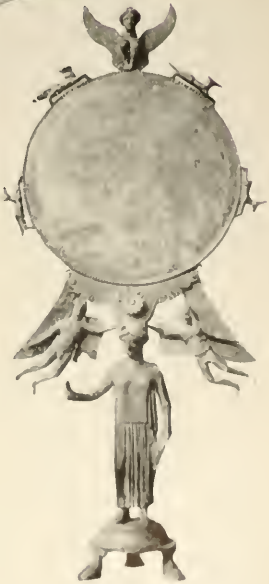
(Left) A PERFUME BOTTLE of terra cotta, bearing two Grecian women with wool baskets, dating from about 460-420 B. C.

CENTURY



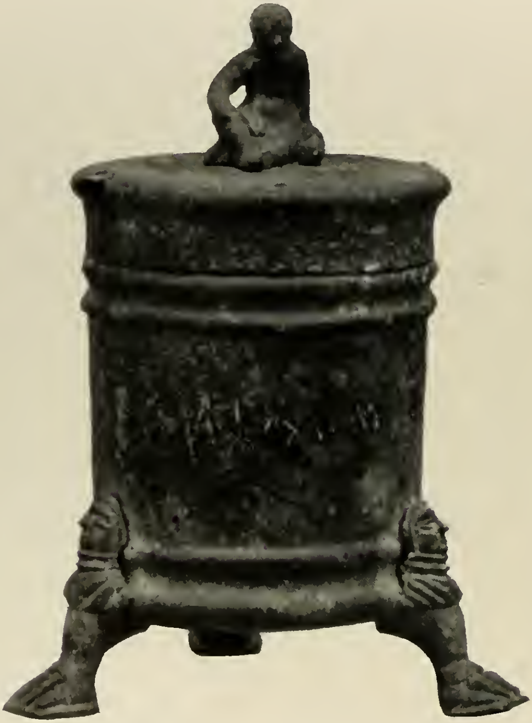
Photos by courtesy of the Metropolitan Museum of Art

An over-night mask of meal washed off with milk in the morning began the toilet of the Greek lady. Eye-shadow and rouge made of vegetable substances including seaweed and mulberry were applied, and sometimes false eye-brows. The Greek women were among the first to use lead carbonate to whiten their faces, which, although it was usually accompanied by unexplained cases of poisoning, often leading to death, remained popular for many centuries

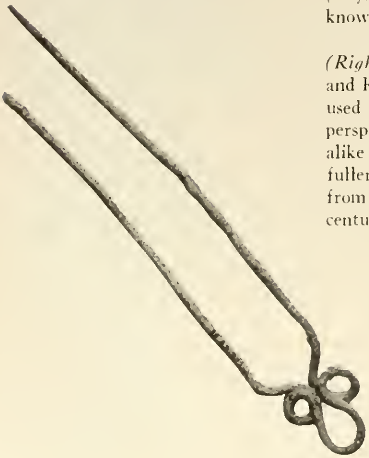


(Right) A greek mirror of polished bronze. The glass mirror backed with mercury or paint was not invented until the 14th century A. D.

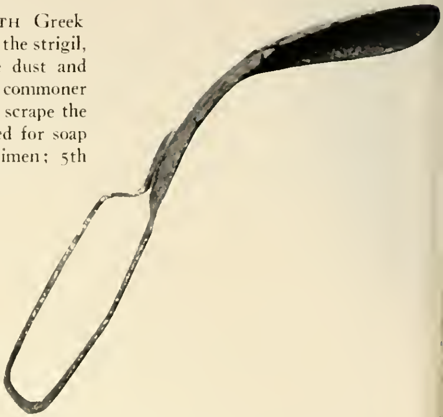
FROM ANCIENT ROME



(Above) A ROMAN TOILET BOX which contained a mirror, strigils, combs, hair pins, rouge pot, etc. Made of bronze, it is inscribed with the word "Suthina" meaning "sepulcralis" or tomb article. Sometimes these toilet boxes had rings attached to the sides and were carried about on small chains, as were vanity cases recently in our modern era



(Left) A ROMAN HAIR PIN of iron, date unknown



(Right) INDISPENSABLE TO BOTH Greek and Roman beauty culturists was the strigil, used also by athletes to remove dust and perspiration. Court lady and commoner alike kept one beside her bath, to scrape the fuller's earth and lye powder used for soap from the body. (A Greek specimen; 5th century B. C.)

The constituents of Egyptian cosmetics were limited both in number and in variety. Thyme and origanum, or sweet marjoram, both aromatic plants of the mint family, and balanos, obtained from the shells of an unidentified fruit, were all grown in Egypt. From Arabia were imported myrrh and frankincense, aromatic gum-resins highly prized as perfumes, and spikenard, which was an ancient and costly fragrant ointment made from the roots of a valerian. These imported herbs were used in the most costly cosmetics and unguents of the time. Almond, olive, and sesame oils, the latter obtained from an East Indian herb, were the favorite vehicles for aromatics.

Beauty treatments in Egypt began with the bath. The commoners followed the bath with olive oil to keep their skins supple. The kings and persons of the upper classes followed the bath with the application of perfumed oils and unguents which imparted a balmy and pleasing odor and gave to the skin the elasticity required in the desiccating heat of the Egyptian sun. The odor was an important factor in these protective oils; the Egyptians were fond of the strongest scents available and used them at all times.

Painted nails no new vogue

It was the embellishment of the eyes, however, which was of the greatest importance to Egyptian beauties. The lovely young Queen Nefertiti, whose sculptured head is reproduced in this article, is an example of the finest in eye-decoration. The gracious queen and her ladies painted the under lid of the eye green, while the upper lid, lashes, and eye-brows were blackened with kohl which was made of antimony and was applied with an ivory or wooden stick. Henna, an orange-red dye made from the leaves of a loosestrife, Lawsonia, was used for coloring finger nails, toe nails, the palms of the hands and the soles of the feet. Stibium pencils of antimony were used as eye-brow pencils. Mirrors, essential in the art of beautification, were made of polished bronze. The glass mirror, backed with mercury or paint, was not invented until the 14th century A. D.

Mirrors were found in the tombs, along with combs made of tortoise shell, metal, and wood; alabaster pallettes for mixing face paints; cosmetic boxes, dishes, and spoons made of wood, ivory, alabaster, or bronze; vases and jars for unguents, creams and pomades. Those who could afford it had seven different creams and two kinds of rouge put into their tombs.

One of the most interesting discoveries in King Tut-ankh-amen's tomb was the noble young king's cosmetic jar. When it was opened, the jar still contained a cream which had an odor suggestive of coconut, but which was later analyzed as an animal fat. The cream had been so effectively sealed from the atmosphere by the reaction of the substance itself with the calcium of the jar that, although it was 3000 years old, it was still intact and was not rancid. The jar itself was made of translucent calcite. It was cylindrical in shape and rested on carved figures; on the lid reposed a delightful recumbent lion with a long protruding tongue, while on the sides, incised and filled with pigment, were scenes among desert plants, scenes of lions attacking bulls, and of hounds chasing antelope, gazelle, and hares. It was a beautiful piece of workmanship, this old Egyptian jar, and it held King Tut-ankh-amen's face cream.

Refinement came to Babylon at one period in the guise of effeminate degeneracy. The women gave their charms to any who asked, while the young men dyed and curled their hair, perfumed their bodies, rouged their cheeks, and wore necklaces, bangles, ear-rings, and pendants. They were the counterpart of the curled, scented, and jewelled fops of the court of Louis Fourteenth in France. Cosmetics, together with the mental and physical degenerates who used them, contributed to the fall of Babylon.

Ancient beauty experts

Not far away from Babylon lay the land of Persia, home of attar-of-roses. During the rise of the Medes in Persia, the people were slaves of luxury and fashion. Men wore embroidered trousers and the women covered themselves with cosmetics and jewelry. Later, when the Medes had fallen and the palmy days of the new Persian Empire were at their peak, both men and women became ardent users of cosmetics. Creams were spread over the face to improve the complexion and colorings were applied to the eyelids to increase the apparent size and brilliance of the eyes. Rouge, however, was used sparingly, if at all. At this time in Persia, special classes of adorners, called *Kosmetae* by the Greeks, arose as beauty experts to the aristocracy.

The Persians were connoisseurs of scents; they were believed by the ancients to have invented perfumes and cosmetic creams. The famous attar of-roses, which simply means "oil of roses," was made of damask rose petals. Not only rose petals, however, yielded their precious volatile oil for the Persian perfumes. Every scented flower gave up its drop of oil, to be hoarded away in vials for the use of the wealthy. Fragrance in creams, perfumes and unguents were deemed essential to Persian well being and happiness. The King of Persia never went to war without a case of costly unguents to ensure his fragrance in victory or in defeat.

Although the Persians were wonderfully adorned, the women of Greece exceeded them in gorgeous attire and facial decoration. The word cosmetic itself is of Greek origin, from the word *Kosmeo,* meaning "I adorn," and the ancient Greeks were a nation devoted to adornment. The Greek women devoted much time to painting their faces, dyeing their hair, coloring their nails, changing the shape and color of their eyebrows, and perfecting their complexions with baths, masks, and paints. Mirrors, as might be expected, were popular and highly prized, but like those of Egypt and Sumeria were made of polished bronze and other metals, and not of glass.

Toilet of a lady

The women of Greece were among the first to use white lead—lead carbonate—to whiten their faces. Although it was usually accompanied by unexplained cases of poisoning which often led to the death of the individual, this substance continued in popular usage for many centuries. Soot was used to darken the eyebrows, and rouge was commonly made of vegetable substances including seaweed and mulberry.

The toilet of the Greek lady began when she put on her face a mask of meal which remained there all night and in the morning was washed off with milk. It was a beauty mask guaranteed to remove blemishes and restore waning beauty. After the morning milk bath, the white lead powder was put on, and then the rouge, the eye-shadow, and the eyebrows. These latter were sometimes false. As the Roman writer Petronius said: "The lady takes her eyebrows out of a little box." False or not, the lady fixed her eyebrows, submitted herself to the hairdresser's fingers, was dressed and heavily perfumed, and then was ready for the day, much of which had already been passed in beautification.

While the ancient Greeks liked heavy scents, there is some reason to believe that men who used them were considered effeminate and scarcely worthy of being called men. Zeno, the Greek philosopher who lived between 333 B. C. and 261 B. C., said on meeting a man redolent with perfume, "Who is this who smells like a woman?" But one cannot say whether the scent of perfume on a man attracted more attention in ancient Greece than in our own time.

Both men and women indulged in fancies for the hair. Blonds were popular in Greece, and while the rage for light-colored hair was at its height, any means was permissible to obtain and display a head of golden hair. Sometimes false hair was used without a qualm and the offending brunet locks of a brunet people were ruthlessly shaven. Others undertook to bleach their hair, after a recipe given by Menander. "The rays of the sun are the best aid in making the hair fair," he said, "and our own men know it. For after they have bathed their heads copiously in a special ointment which they make here in Athens, they sit in the sun, their heads uncovered, and wait there for hours for the hair to turn. And it does. Their hair gradually becomes a lovely golden color." This preparation which was used by the old Greeks may have been the same as a special ointment made in Italy in the 10th century.

"Take dried cauls from the Orient," the old recipe reads, "grind them to powder and mix in equal proportions with yolks of eggs that have been boiled, then mix with wild honey. Rub on the hair in the evening and wrap the head in a kerchief. Wash the next morning with olive oil and soap in fresh water." The user is advised to sit in the sun all day after using the ointment, "being careful not to get a sun-stroke."

Both men and women in Greece used an implement which may have been a greater beautifier than all the preparations they might find. This was the strigil or flesh scraper, with which, after the bath, they removed from their bodies the fuller's earth and lye powder which were used as soap. The strigil also removed dead skin and kept the live skin glowing and healthy.

Romans stole beauty secrets

From the Greeks the Romans stole beauty secrets, for not until the Romans became acquainted with the Greeks of Southern Italy did they think of enhancing their personal appearance. Then, by capturing the beauty doctors of Greece, in the approved manner of the lusty, over-impulsive Romans, Rome acquired the secrets of Grecian beauty.

By the time Nero was Emperor of Rome, cosmetics and perfumes were playing an important rôle in court life. Nero personally used many cosmetics, while Poppaea, his wife, made no secret of the artificiality of her toilet.

Queen Poppaea must have devoted a great deal of time to perfecting the intricate details of her complexion, hair, nails, and dress. At night her face was covered with a poultice of boiled or moistened flour which dried and hardened to a fragrant mask. This was washed off in the morning with asses' milk, a method designed to clear the complexion and make it smooth and attractive. Poppaea employed one hundred slaves to paint her face, to roll up the tight little curls of her coiffure, and to pack the curls properly with gum arabic. Poppaea bathed in nothing so common as water. For her bath no milk but that of the ass was used, for the queen's oracles had assured her that in this milk lay a magic which would dispel all disease and blights from her beauty. White lead and chalk were used to whiten her skin. Egyptian kohl darkened her eyelids and eyelashes. Fucus, a rouge obtained from a seaweed of the same name, was put on cheeks and lips; "dragons'-blood" and the fat of sheep was made into a pomade and used on her nails. For occasional freckles bestowed by the ruthless Italian sun, she applied an oatmeal paste and lemon juice; for undesirable hairs, a depilatory made of a fern called Psilotrum was used. Pumice stone whitened her teeth; and she bleached her hair with a soap brought from Gaul. For any pimples or skin eruptions which chanced to appear, barley flour and butter were used.

The risks of artificiality

Poppaea and the other women of Rome and Pompeii dared not expose their hand-wrought complexions to the sun for very long at a time lest their enamel—a solid coating of white lead, red lead, kohl, and chalk—should melt. Neither did they dare expose their curls to the rain, lest stringy locks result; nor even, in some instances, to cough lest they lose their teeth. Upon marble brows Roman ladies gummed beauty patches. Even the delicate blue veins, which were so much to be desired because they denoted the fragility essential to a true lady, were painted on their whitened brows. Poppaea and her ladies were as highly decorated as any ladies in history, even though their cosmetics were crude and dangerous, their method tinged with superstition and ceremony, and their finished products conducive neither to ease nor to activity.

Then, as now, there were two factions, one opposed to the artificial decoration of woman, and the other supporting it. These two viewpoints were found in certain of Plautus' plays. In his comedy of the "Haunted House," the girl who was dressing to meet her lover demanded make-up as a finishing touch. When she asked for white lead for her face, her old tiring-woman objected that one doesn't make ivory whiter by using what is soot by contrast. "Rouge," said she, "would spoil the lovely picture. Paint is not for youth, nor white lead, quince ointment (peroxide), or any other cosmetic."

In another one of the comedies by Plautus, two Carthaginian girls spoke for and against cosmetics as an aid to winning men. One declared that cosmetics were necessary to beauty; the other said that one must merely be neat, for good food needs no seasoning. To this the reply was made that a woman unadorned is like food unsalted. The more conservative girl then pointedly told her sister that she might be beautiful if her face were not so smeared by cosmetics.

The Roman conquerors, when they came riding into Rome after a conquest, painted themselves with vermilion dye, and Caesar, in his Commentaries, mentioned the fact that the Britons were strangely painted for battle. When Caesar went to Egypt, he found the beautiful Cleopatra painted with kohl and lead, with henna on the palms of her hands and the soles of her feet, with red pomade on her nails and on her breasts. But cosmetics were nothing new to Caesar, for Caesar came from Rome.

Although the women of Rome had painted their faces for many centuries, the women of China had been doing the same thing in nearly the same way for thousands of years. No one knows how long the Orientals have used cosmetics—perhaps not as long as the queens of Sumeria, but surely as long as the queens of Egypt. China was civilized when Greece was still inhabited by barbarians. It saw the rise and fall of Babylon, Assyria, Persia, Judea, Athens and Rome.

In China, the peasant women, nearly as big and strong as the men, used no cosmetics. Such things were for the sing-song girls and the upper class ladies—the Manchu belles, the Ming beauties, the Tartar charmers—all of whom were delicate and pretty. Upper class ladies were invariably starched with powder, and had rouged lips, rouged cheeks, and blackened eyebrows which were trained or thinned to resemble willow leaves or crescent moons.

Gilded lips

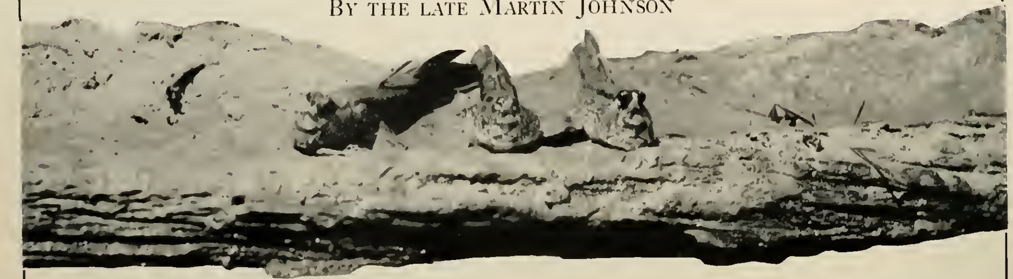
Powder for centuries has been the female complexion of Japan. Lady Sei Shonagun in 991 A. D. said coyly: "I bent down my head and hid my face with my sleeve, at the risk of brushing off my powder and appearing with a spotted face." Fashionable ladies rouged their cheeks, whitened their faces, colored their nails, and occasionally added a unique note in gilding their lower lips. To complete their toilet, Japanese ladies required sixteen or more articles. There were fifteen styles of front hair and twelve of back hair. They shaved their eyebrows and painted arches or other forms on their foreheads to match their artificially blackened teeth. In the early days of Japan every male of quality rouged his cheeks and carried a mirror wherever he went.

No matter how deeply the history of cosmetics is delved into, no one will know, perhaps, exactly how they originated nor when they first began to appear

Continued on page 700

Tree-Climbing Fish

By the late Martin Johnson



Among the most interesting photographs taken by the late Martin Johnson on his last expedition to Borneo are these of the tree-climbing fish, or mudskipper. Especial importance is attached to them as they are perhaps the only ones of their kind ever taken.

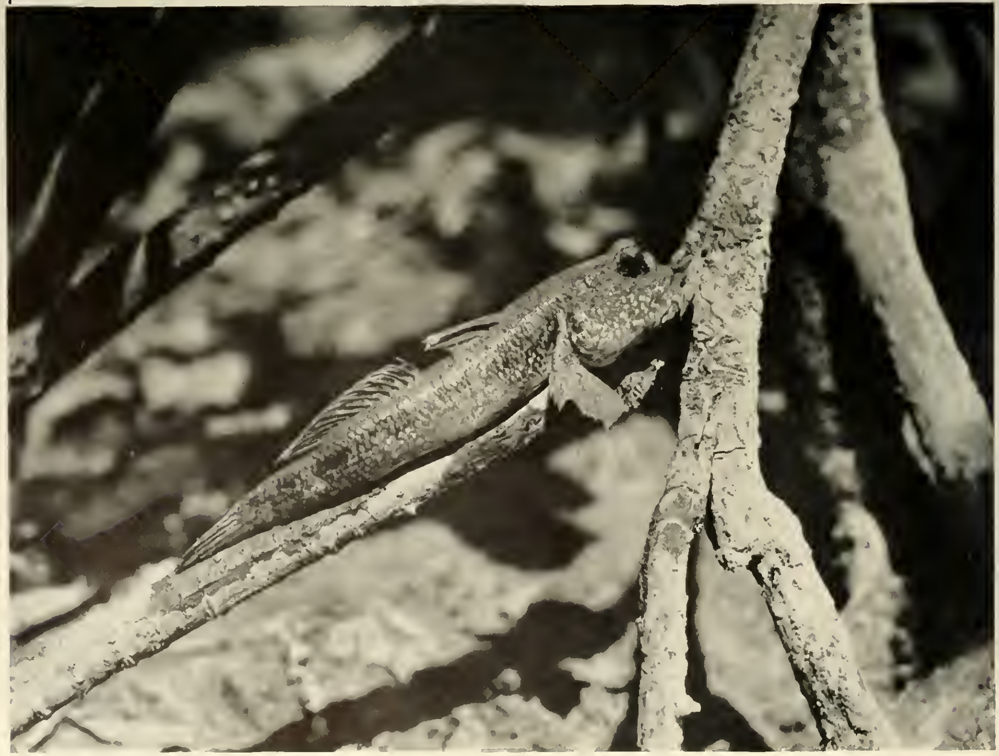
The sloping roots of the mangrove tree, up which the specimen shown has worked its way by action of its forward fins, are a favorite aerial retreat of this strange creature.

When not tree-climbing, the fish enjoys long periods of repose at the water's edge with only its tail submerged. Second only to its walking and climbing ability is the fact that it "breathes" more efficiently through its tail fin than by means of its gills. Tests prove that it can survive for a day and a half with only its tail submerged, while if only the gills are allowed to function, it lives but 12 to 18 hours.

When alarmed, the mudskipper springs by means of its bent, muscular fins and then skims across the water to safety by a succession of short jumps.

Note the movable, bulbous eyes, which excel the eyes of ordinary fishes in being adjustable to vision in the air. Without them, this fish would see no more distinctly out of water than a person can see in it. But a specially developed muscle enables the climbing-fish to shift the spherical lens of its eye so close to the retina as to produce a sharp image, even of objects not in its immediate vicinity.

Its remarkable eyes and its respiratory tail fin make this fish a scientific curiosity as well as an object of wonderment to all who have witnessed its tree-climbing, tail-breathing activities.



NATIVE AMERICAN THANKSGIVING—*For untold centuries before the arrival of the Puritans the American Indian celebrated the yearly harvest-time with turkey, pumpkins, and ball games*

By TE ATA

of the Chickasaw Tribe

IN AMERICA today there are many people who believe that Thanksgiving in this country originated with the Plymouth Colonists in 1621. Admitting that these white settlers may have brought in with them a Thanksgiving spirit, it should not be forgotten that the distinctive features of the American Thanksgiving are native to the country rather than to the settlers, and that the Indians had been offering up their thanks for untold centuries.

Late in the summer season that follows close upon the trail of the harvest, the native American has, since ancient times, given thanks for fruits of the soil and of the chase to the Great Spirit and to the Earth-mother. It mattered not whether the harvest had been rich or lean, when the right time came, the ceremonies, the games, and the feasts were held.

At the time of the coming of the white man to this country, many of the Indians in North America had come to the agricultural or planting period of their civilization. Among those living in permanent houses and of less nomadic tendency were some of the tribes of the Southeast known as the Muskogean group, comprising such important tribes as the Chickasaw, Choctaw, Creek and Natchez. With these tribes, Thanksgiving or corn festivals held an important place, and it may be of interest at this time of year to hear something of one of these long-ago festivals.

Eight-Day Thanksgiving among the Creek

Soon after the corn became ripe, a day was set by the Mico or Chief of the Creek Indians for the eight-day festival, known as the *Boos-ke-tuh* or *Busk*. This ceremony was both *religious* and *political*. The Great Spirit was thanked for the benefits bestowed upon his children and at the same time the tribesmen brought gifts to their head Chief and the village granary was filled with voluntary contributions.

On the appointed day, just as the sun appeared above the horizon, the Mico came to the door of his cabin, situated on elevated ground, and greeted the "Giver of Life" with three long calls. Then, after lighting his calumet, he wafted the smoke three times—to the Sun, to the Earth-mother, and in a circular movement to the four corners of the earth.

Preparations for the festival

The bustling antics of an American household today as it prepares for the feast seem almost undignified when compared with the ceremonious prologue to the Creek Thanksgiving. On the first day, the warriors cleaned the square and sprinkled it with white sand. With elaborate ceremony four great logs were placed in the center of the square, end to end, and pointing toward the four cardinal points. In the center the fire was made that would last through the year. The fire-maker kindled the new fire by the friction of rubbing two sticks together. The logs were large and long enough to burn four days and then four more logs were substituted for the four remaining days of the ceremony. This fire remained the mother fire through the whole winter until the *Boos-ke-tuh* was again celebrated.

During this season everything was made clean, the person and the dwelling place; new mats made of cane had been brought into the cabins, new plas-

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TE ATA is the foremost exponent of American Indian folk-lore on the stage today. Her programs are distinguished by the dignity and beauty with which she portrays the Indian philosophy and the creative mind which gave to the American continent its first great culture. Te Ata presented a folk-lore recital at President and Mrs. Roosevelt's first formal dinner in the White House and has given command performances before royalty abroad tering for the walls, and an emetic, known as the "black drink" and made of Yaupon (*Ilex Cassine*) was brewed and taken by the entire tribe. (Some less violent medicinal treatment might well be prescribed for the modern American community as an aid to surviving the annual digestive ordeal.) Thus the whole village had taken on a kind of "fall cleaning", for this was the time of purification, as well as rejoicing and thanksgiving. In this respect, Thanksgiving had something of our New Year's Day for the Indian. It symbolized turning over a fresh leaf—starting out anew.

There was a strange beauty in the conception of the *Boos-ke-tuh*. "It restored man to himself and his family. It absolved the Indian from all crimes, murder excepted, and gave him a chance to start anew. It was the season for moral and physical purification, general forgiveness . . . and united thanksgiving."

Fashions among Indian women

Since the coming of the dawn, the women had been busy, getting together the needed utensils, dressing in their best ceremonial clothes and preparing for the festivities. Out of beautifully decorated little cane baskets or boxes, women brought forth their mirrors made of mica and their combs fashioned from wood or shell. The prevailing style of hair-dressing among these women was very simple: their long, coarse, black hair was parted in the middle and tied at the ends with ribbons made of bison hair or perhaps with ribbons woven of the inner bark of mulberry, finished with tassels at the ends or decorated with porcupine quills.

Even at that period the women varied greatly in the art of fashion and, had we looked in upon some maiden, well versed in this art, we should have found her, no doubt, deeply engrossed in decorating herself in the latest Indian fashion or style of the day. There she sat, in the shadow of an old juniper tree combing her long hair. It had been oiled, combed and braided and tied with freshly woven ribbons which had been dyed a brilliant red and decorated with tassels and shells. From her basket she took out a small skin bag of vermilion with which she painted her cheeks and then painted decorations on her forehead and shoulders. The weather was warm, so she wore few clothes. She had on a short wrap-around skirt reaching from waist to knee that was made of soft white deer skin, its simplicity of design allowing her freedom for walking. On her shapely feet she wore moccasins and should the night turn cool she would wear the soft robe of bison skin that was thrown across a pole near-by. There were also shawls made of the inner bark of the cedar or the mulberry into which were woven hundreds of tiny colored feathers of birds. These would be worn by some of the older women whose husbands were very good hunters. Then the young woman took from her treasure box a necklace of fresh water pearls, another of shell, and slipped over her arm an unusual bone bracelet, and her toilet was complete. Placing her lovely basket in the bark house and throwing the robe over her arm, she joined the crowd in the ceremonial square.

Men's fashions

Although modern women may rival their primitive sisters in trying to look their best at the great feast, it would be difficult to find an American male today willing to ornament his person in the manner of the Indian men (unless a masonic ceremony or a Legion parade gave him sufficient excuse). These men were proud and vain and were fond of decoration. They shaved their hair on either side of the head, leaving a kind of roach in the center, some of the hair being purposely left long so that beautiful feathers and shells might be tied to it. No men allowed hair on their faces for this was not the Indian fashion, so they would take great pains to keep any stray hair pulled out with tweezers of wood or of shell. Also their bodies were smooth and coppery and sometimes they painted their entire bodies, and many of them were tattooed. In the summer no clothes were worn save the breech-cloth and the moccasins. In the winter they wore long leggins and shirts of skin, and over that a furry robe of bison or muskrat. They wore feathers, shell-beads, ear-rings, and to complete their costume they carried a turkey-feather fan and a gourd-rattle. They were well built and handsome and carried themselves with pride; they danced with animation and great ceremony.

The young children, to about the age of ten, went entirely nude, except for the baby who was strapped on a board padded with moss and wrapped in soft skins. After the boy became older he wore a breech-cloth and the young girl wore a fringed apron made of woven bark or of soft skins.

At the corn ceremony the men danced all night, until the coming of the dawn. Then they retired and did not come forth again until summoned by the call of their Mico or Chief, just before the sun reached the middle of the sky.

The remainder of the day was spent in speech-making, preparing tobacco for their ceremonies, tending the fire, playing ball and other games. On the last day the great Chief usually made "big talk", exhorting everyone to be exact in the performance of duty, to instruct his children carefully, to remember to venerate their dead. Also if anyone had distinguished himself during the year by an act of great bravery, this would be recounted that all might hear and think upon it.

The annual Thanksgiving day football game has become an integral part of the modern feast, and the Indians had ball games too, fully as colorful as the modern contests, and even more arduous. These ball games were very exciting and were played with swiftness and grace. Wearing only moccasins and breech-cloth, their bodies shone in the sun as they ran, making a picture long to be remembered. The ball was made of skin stuffed with bison hair. The sticks were usually made of hickory and one end was bent back on itself and tied with thongs to form the rim of a cup made of skin lacings. Two were carried by each player and in this cup the ball was caught and from it the ball was thrown toward the goal. This game was the forerunner of the game now known as Lacrosse.

The women lighted their new fire from the central flame and when the time came for feasting, they took their carrying baskets to the public granary where they were given fresh corn, grown and gathered especially for this feast and placed in the granary by warriors only. This they took to their respective houses and pounded in their wooden mortars. The water had been heating in large pottery jars into which was placed the corn when ready. Dried berries had been brought from their storage place and meat was roasted on sticks over the fire or cooked with the corn.

Thanksgiving foods

These Indians had a variety of foods for their Thanksgiving feasts that would be well received by America of today. What would a Thanksgiving dinner be like today without the traditional turkey, pumpkin pie, potatoes, and nuts? These foods were introduced by the Indians, for their delicious flavors were known to them long before the coming of the white man to these shores. It is true that they did not use the pumpkin for pie, but in some parts of the country they did cook it and sweeten it with honey or with maple sugar, depending on the locality; then into this they mixed berries that had been dried and nut-meats, making a dessert that any palate would find delicious. Sometimes they made a kind of Indian pudding, using corn-meal pounded fine, cooked it in water and stirred into it nuts and dried berries and a little sweetening. Sometimes they cooked corn with meat and water, after removing the hulls or seed coats, making a dish that the Chickasaws called *pashota*. The Indians made a bread of corn pounded fine and seasoned with salt and with bear's fat or hickory-nut oil. This was cooked or fried on hot stones or on a flat pottery dish made for that purpose, or on a clean-swept hearth, that the fire had left hot, with a pottery dish over it and coals and hot ashes over the dish.

Some of the dances of the ceremony were done by both men and women, the men in one circle and the women in another; others of them were done separately. Gourd-rattles and beautifully decorated pottery-drums were brought forth, and to their rhythm, while singers chanted their songs upward to the ear of the Great Mystery, the men, women, boys and girls danced their old patterned rituals. A well-known ethnologist once made the statement that the Indian did not preach his religion,—he danced it. From this remark one can be certain that he had witnessed the old rituals handed down from ancient times.

With the festival over, the crops were harvested and each man carried to his own granary his own maize and berries. Also there was a large granary called the Chief's granary to which each family gave a portion of his harvest, whatever he desired. It was in truth a kind of public granary made up of voluntary contributions to which any person had access when his private store was gone. In these days of depression it might not be amiss for each village in our country of today to emulate the ways of these early Americans in this respect.

Thanksgiving still exists among the natives of our land today. Out toward the place where the sun goes down, the Indians of the Southwest still dance their thanks for the bountiful harvests. Regularly each year, at the appointed time, the Hopi and other Pueblos, through their old rhythmic dramas, ask the gods for rain to water their corn, and thank them for bounteous crops. Perhaps the best known among the corn dances is the one still given at Pueblo Santo Domingo, near Santa Fe, New Mexico, for this tribe is conservative and their dance retains much of that which was handed down from the past, probably the best preserved ceremonial in the Southwest.

Native Thanksgiving near "Big City"

Near the rising sun and the great city of the white man, even there the old corn festivals and harvest dances still persist among the native Indians. Ceremonies are still held on all the Seneca reservations, and on the Onondaga reservation near Syracuse, New York. Mr. Arthur C. Parker, well known Seneca Indian, now director of the Rochester Museum, tells me that the New York Iroquois have

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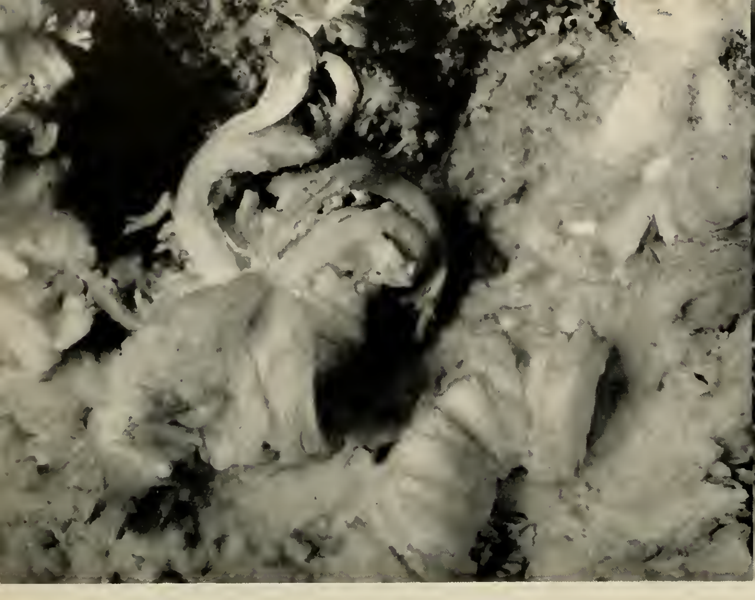
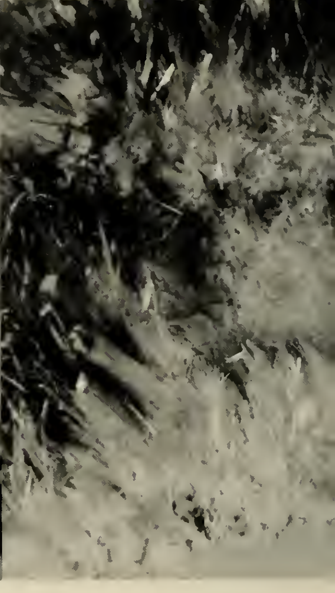


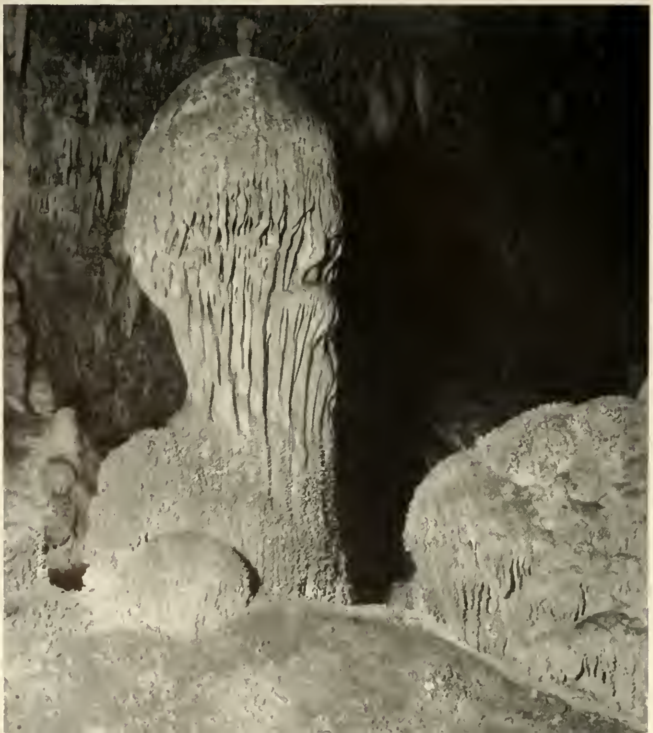


(Above left) A MINERAL ORCHID in full bloom raises its petals of glistening white gypsum in one of the Kentucky caves

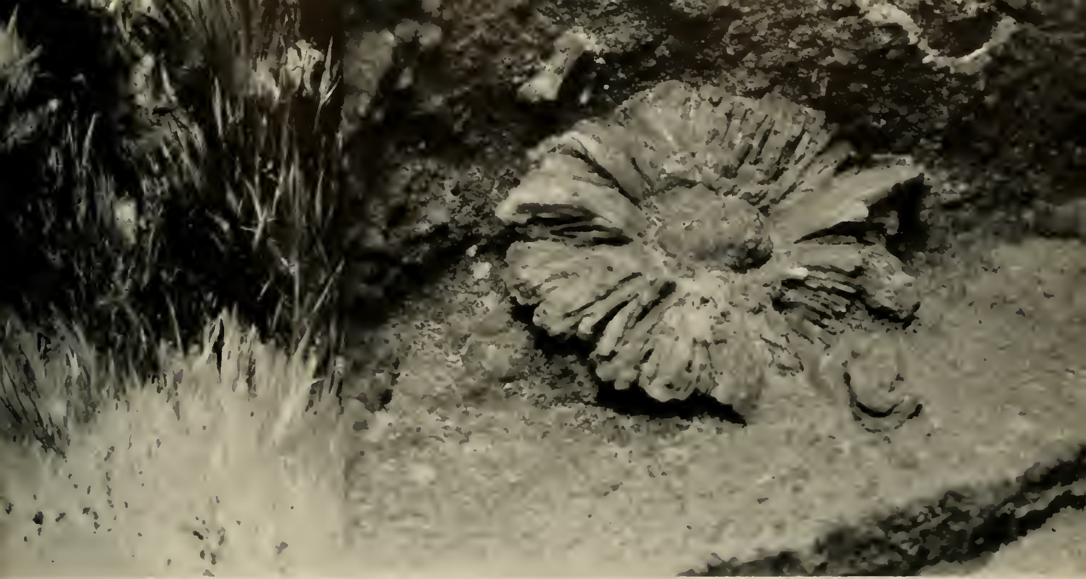
(Above center) A BEAR-SKIN RUG adorns the side wall of this cave. The fur is a rare form of gypsum crystallized into long, fragile spicules

NATURAL

Showing some of Nature's remarkable cave formations fashioned in the likeness of plants and animals



(Left) GIANT MUSHROOM: a towering stalagmite that greets the wondering eyes of visitors to the Carlsbad Caverns in New Mexico

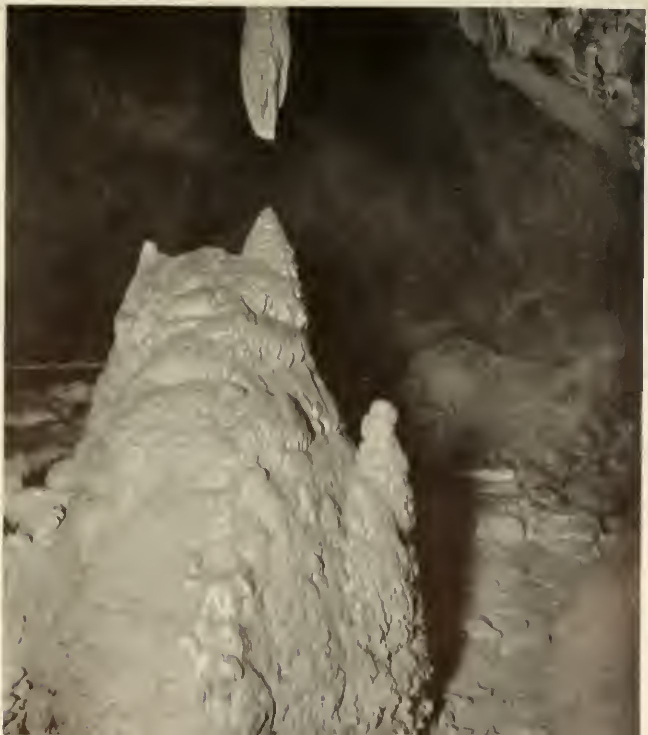


(Above) NATURE DUPLICATES a flower in solid rock. This striking formation is found on the wall of a narrow passage in a Kentucky cave. Nature spent thousands of years building most of these natural art works, formed by the constant dripping of water and the slow process of crystallization

WORKS OF ART

Photographs taken in the caves of Kentucky and the Carlsbad Caverns by Russell Trall Neville

(Right) A CAT squats on its haunches in a Kentucky cave. Some day his right ear will reach up to join the stalactite directly above



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six thanksgivings each year, their harvest thanksgiving taking place late in November.

Handsome Lake, famous Indian prophet of the nineteenth century, gave to his people a religion that many of them still follow to this day. In one version of his teachings, occurs the following:

"It has pleased our Creator to set apart as our life, 'The Three Sisters'. (Corn, beans, pumpkins or squash.) For this special favor let us be thankful. When you have gathered in your harvest let the people assemble and hold a general thanksgiving for so great a good. In this way you will show your obedience to the will and pleasure of your Creator."

From the time of the festivals held at ancient Chi-chen-Itza to the ones seen in our land today it was customary to give thanks for the harvests. Therefore it seems good that America know and remember something of her heritage from the American Indian, and in her justifiable pride in having brought with her from the old country such a fine custom as that of offering thanks, let her remember that this ceremony had an independent origin in the America of the Red Man.

"The Great Spirit made all things—
He is in all things;
He is in the air we breathe;
He is our Father,
But the Earth is our Mother—
She nourishes us;
That which we put into the ground
She returns to us."

Thus they said!

"Slaughter of Non-combatants"—*Like star-dust in the path of an alien planet, myriads of insects clash with man's mechanical world*

By ROBERT CUSHMAN MURPHY

THE evening of August 7th was calm, hot and muggy. By seven-thirty it had become dark enough for headlights and, when we set forth from Saunderstown on Narragansett Bay to drive westward across Rhode Island, the still atmosphere ahead suddenly seemed filled with snowflakes. "Hail?" I questioned. But it turned out to be myriad insects, swarming and dancing and doubtless mating on the wing. Numberless kinds they were, large and small, as we could presently tell from size, silhouette, relative translucence, or the brief glow of jeweled eyes, during the twinkling in which they flew through the cones of light. Now and then a heavy beetle or shining moth would streak like a comet across a field of star-dust. Variety, however, was wholly secondary to the impressiveness of sheer numbers.

A long drive lay ahead, and fifty miles an hour seemed reasonable on a smooth back-country road. As we accelerated toward that speed, the impact of infinitesimal flying bodies against the vehicle made first an irregular rattle, then a tattoo, and finally a sound that may best be described as a hissing purr. The last was accented whenever one of the oversized projectiles in the barrage thumped its mark. It is difficult to conceive of the smashing effect of large mass and high velocity in contact with forms so light, but the bursting and splashing of tiny abdomens on the wind-shield gave visual evidence of the swath we were tearing through a protoplasmic fog. The glass became peppered and blurred with fragments of exploded insects. Yet most participants in the collisions doubtless left no mark at all and, furthermore, the wind-shield formed but a small proportion of the car's cross-section.

On and on we sped, while insects rained without cessation against steel and glass. Countless automobiles that we met were, of course, slaying their other millions. Across hill and valley, through wood and meadow, the swarms held out, and only at New London, an hour along our course, did we pass beyond the area or period of the insects' midsummer night's dream.

Next morning the bespeckled motor car had been sluiced and sponged before I saw it. But the routine had fortunately missed the front bumper, and there, as a mere trace of the night's carnage, a total of more than eleven hundred insects, ranging in size from small moths down to midges, remained stuck by their own coagulated juices to the chrome-plated metal band.

How many lives had we taken, and what of it—can either part of that question be answered? What was the toll of five thousand cars in the same region during the hour or more of swarming? Did it constitute a serious drain, or only a negligible casualty—a mere "drop in the bucket" out of the unimaginable abundance of life? What other hazards to insects are there now, or have there ever been, to compare with motor cars? What promise for good or evil lies in an indefinite continuance of such holocausts through other August nights?

THE INDOOR EXPLORER

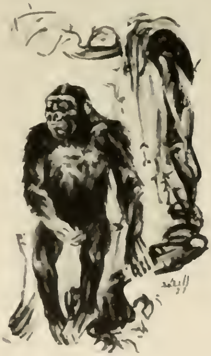
Zoo Animals and the Museum

THE gorilla, John Daniel, lived in a third-floor flat on Sloane Street, London, where he slept in a bed with sheets and blankets, ate at table with knives and forks and used the bathroom like a model child. During the summers of 1919-20, he was a cheering sight to war-weary Londoners as he rolled up to the Zoo in a taxi, entered one of the cages, and showed off his bizarre tricks before the crowd that always stopped by for the tri-weekly entertainment he provided. After the show John Daniel and his owner would take another taxi back to the flat in Sloane Street.

But John Daniel, insatiable lover of crowds, could never confine his showmanship to the Zoo. He knew how to unlock and open the windows facing on Sloane Street, and many a traffic jam piled up in that thoroughfare at sight of John's precarious antics. It was from this lofty proscenium that he once came close to breaking the discipline of the British Army by a particularly inspired window-act for the benefit of the royal guards who were marching through Sloane Street en route to Buckingham Palace.

But John Daniel doesn't live in Sloane Street any more. He, or rather an excellent taxidermist's restoration of him, has been living quietly enough at the American Museum these sixteen years. The dark and devious story of how he reached his final resting place on these shores cannot be included in this summary. Let it suffice that although he died in New York at the age of six (early manhood for a gorilla) his exploits had been such that he was and probably still is the most celebrated primate in Christendom.

Your Explorer had passed by John Daniel many times in the course of his excursions along the third floor of the Museum. But knowing the gorilla's picaresque history, it seemed something of an anticlimax to see him thus reduced to a mute and passive piece of still life. So your Explorer never lingered long—that is, he didn't until one day it struck him that there was something peculiar about John Daniel that distinguished him from the other animals in the case; that distinguished him, indeed, from all other animals in the Museum exhibits. No, there was no flaw in the mounting or posture of John Daniel; it wasn't a matter of overt appearances, but the sudden realization that this gorilla was, after all, a captive specimen. And here was a captive specimen on exhibition in the halls of the American Museum, which, as this Explorer got the facts, were supposed to be given over exclusively to the display of *typical* animals, taken in their natural habitat. For two years John Daniel had lived like a human being in Sloane Street and just before that, he had been stationed for six weeks in a London department store as a publicity stunt—activities which could scarcely be called typical of gorilla life.



Could John Daniel be a rank intruder in these halls predicated to the depiction of wild life? Was John Daniel a skeleton, so to speak, in the Museum's closet?

Shocked at all the sinister possibilities of the situation that came tumbling one after another before his mind's eye, your Explorer sought out Mr. T. Donald Carter, Assistant Curator of Mammals, and began cautiously to sound him out on the subject of John Daniel. But as Mr. Carter maintained an unruffled equanimity in the face of the darkest insinuations flung at him, this writer was forced to conclude that his fears were unfounded.

"It is true," said Mr. Carter "that John Daniel was a domesticated gorilla, and it is also true that he is the only completely mounted zoo mammal on exhibition in the Museum. But that was not the case until we gave Caliph back."

"Gave who back?"

"Caliph," repeated Mr. Carter calmly. He stacked some papers on a corner of his desk, stared thoughtfully out the window for a moment, then further confused your Explorer by inquiring, innocently enough, "Have you ever heard of Mrs. Murphy?"

The writer said that he recalled the legend of a certain Mrs. Murphy which had to do with a pot of chowder and somebody's overalls. This turned out to be the wrong Mrs. Murphy.

"The Mrs. Murphy I mean," Mr. Carter explained, "was a hippopotamus—I mean literally."

"And Caliph?"

"Caliph was a hippopotamus too," said Mr. Carter. "He was Mrs. Murphy's second husband."

It seemed that Mr. Murphy, who was Mrs. Murphy's first husband, and Calpih, who was Mrs. Murphy's second husband, were by way of Mrs. Murphy the fathers of all hippopotami born in this country up to about fifteen years ago.

"We never happened to get hold of any part of Mr. Murphy, but we did get Mrs. Murphy's skeleton when she died. However, Caliph was the only one we mounted," Mr. Carter informed.

"And Caliph was here until last summer," said your Explorer, grasping the situation at last, "then what happened to him?"

"When the zoo gave Caliph to us," Mr. Carter mused, "we mounted him, put him on exhibition for nearly thirty years, and then last summer we gave him back to the zoo."

The writer had the sudden weird vision of a stuffed hippopotamus in a cage at the zoo. But Mr. Carter soon set him right on that score. When big animals like hippopotami and elephants are transferred at their death from the zoo to the Museum, the entire animal is delivered only when the Museum comparative anatomists wish to make dissections for internal studies. The usual procedure calls for the zoo to phone the Museum telling them of the animal's death. If the Museum wants the specimen they send someone to secure only the hide and skeleton which are removed right in the zoo and taken back to the Museum. That is what happened in the case of Caliph. And, as is customary with the larger animals, Caliph's hide was not stuffed but mounted over a life-sized plaster cast. The finished product was placed on exhibition for several years, after which the skin cracked badly and had to be peeled off. Accordingly a Museum artist set to work and wrought upon the blank surface of Caliph's plaster model an authentically textured replica of his hide. The result was as close an approximation of the actual hippopotamus hide as an artificial flower is of a real one. Thus, Caliph, in new dress, remained on exhibition until last summer, when due to the fact that a wild hippopotamus was expected to be added to the Museum's collection, the Mammal Department contacted Captain Stout at the Central Park Zoo and inquired if he would like to have back what was left of Caliph for old times' sake. Headkeeper Stout gladly accepted the offer and Caliph's "statue" was placed in a sort of Valhalla of famous zoo characters over at the Brooklyn Zoo.

"Now, as to John Daniel," Mr. Carter continued, "you seem to have gotten the idea that there is something *infra dig* about our putting him on exhibition because of his being a captive specimen. But although he is unique among our mammal exhibits, there is precedent aplenty for the display of zoo specimens, particularly in the Ornithology Halls where a good number of the birds on exhibition were presented by the zoo. You see, it all comes down to this."

Mr. Carter proceeded to enlighten your Explorer on several counts. In the first place, wild specimens were favored for display purposes because they were generally much better looking than their captive counterparts. Secondly, the Museum has, unfortunately, no control over the time of year at which the zoo animal may choose to die. He may depart from this earth, for instance, in the middle of his moulting when his fur is in an unsightly condition. What the Museum prefers to do is send out expeditions at a time when the wild animal's fur will be at its best, thus insuring an esthetically desirable specimen. Therefore, the wild animal of a given species is mounted whenever it is possible to secure one.

"But if no wild specimen can be obtained," Mr. Carter concluded, "we have no compunctions about exhibiting the next best thing—a zoo animal—provided, of course, that the specimen comes to us in good condition."

Mr. Carter went on to tell that when John

Daniel died in 1921 the Museum needed a good type specimen of a young gorilla for exhibition purposes and that it was rather because John Daniel fulfilled all the qualifications of this need and not that he was being preserved as a memorial that he was given a place in the Museum's exhibition halls.

"Of course, since that day, we have been fortunate enough to get a good many wild gorillas, and so from a purely scientific point of view, John Daniel's value has diminished with the years."

"But you're not planning to remove him, are you?" asked the writer.

"Oh, no. He still serves his purpose, and out of respect for his illustrious history, we don't want to remove him unless some unforeseen circumstance forces us to do so."

"I'm beginning to think," remarked your Explorer, "that the Museum gets many more animals from the zoo than I at first suspected."

"Probably so," Mr. Carter replied. "We have a sort of first mortgage on every animal in the zoo and they have been very cooperative about giving us their dead. Thus the zoo animal really lives two lives: his normal span of life at the zoo, and an indefinite period of service to us after his death."

"Do you always accept an animal when it dies in the zoo, or do you take only the rare ones?"

Mr. Carter said that his department was anxious to get nearly every specimen the zoo had to offer, but that almost as important as the animal itself was a detailed history of his origin and life up to the time the Museum received him.

"It can almost be said," Mr. Carter remarked, "that the value of each specimen is in proportion to the specific information we have about it."

By means of the widespread acquisition of both zoo and wild specimens, the Mammal Department under the direction of Dr. H. E. Anthony, its Curator, has built up a constantly increasing study collection, made up of those animals who never find their way into an exhibition case. In a sense they are the Museum's forgotten animals. They are forgotten, that is they are never known to the visiting public; but they form the material without which the scientific classification and painstaking observations could not go on.

This study collection is a vast treasury of mammal specimens in which more than 100,000 animals of every description and coming from every corner of the earth have been and are being catalogued according to biological classifications and geographical location. Enormous moth-proofed closets, containing enough fur pelts to provide an entire feminine community with luxurious, if strangely variegated, warmth; deep vaults, refrigeration units, and countless rows of storage trays—all these and more are needed to house the tangible results of a thousand expeditions. The growth of this collection is synonomous with the growth of the Department itself, and the latter is considered by those in authority the most rapidly developing branch of Museum activity.

"Our purpose in building up the collection is not only to enable Museum men to contribute more and more data to the known facts of animal life," said Mr. Carter, "it also serves as the best kind of reference library for all scientists whatever their affiliation."

By persistently increasing the size of this study collection, mammalogists are able to add little by little new and significant information about each mammal type. There are, for instance, a thousand different kinds of mice: one kind may be distinguished by the physical characters that go with an ability to swim, another by a body structure suitable for burrowing, a third by specializations that enable him to climb. And the student of mice needs not only one specimen of each different kind, but several specimens—each typical of a particular kind of mouse at a particular time of life and at a particular time of year. And what is true of mice is, in some measure, true of all mammals.

"But," objected the Indoor Explorer, "isn't it possible that a mammalogist might be sent on a wild goose chase, if he observed both zoo and wild animals indiscriminately and then . . ."

"No," interrupted Mr. Carter, "zoo animals are kept scrupulously apart from wild animals in our files, and any careful mammalogist will examine a zoo specimen only with the greatest reservations, discounting all characteristics that could possibly be ascribed to a captive environment."

"Then there are certain characteristics peculiar to zoo animals?"

Mr. Carter nodded affirmatively.

"Well, then, going back to my original argument, I should think it would be unscientific to place zoo animals on exhibition."

Mr. Carter explained that it was quite possible for a zoo animal to show no visible signs of outward deterioration. "In our department," he said, "it is usually a question of the animal's fur."

It appeared that the "first thing to go" in an animal when taken from his natural habitat and placed in the zoo was usually the fur.

"Animals tend to moult differently in the zoo than they do in the wild due to changes in climate," Mr. Carter said. "And sometimes they even develop different types of fur."

As instances of the change in fur brought about by climatic conditions, Mr. Carter told of a group of Asiatic Deer in the Bronx Zoo. When they were first brought to their new surroundings, they had the sleek fine-haired coats typical of their kind. But under the environmental pressure of the harsh winters well known to residents of the upper Bronx, these transplanted deer began to develop shaggy, thickly matted fur quite different from that normally observed in such specimens.

Lion fur sometimes changes in a like manner in strange climates. Several lions at the Washington, D. C., Zoo which were taken from a section of East Africa where the climate was particularly dry, developed a coat that grew darker with each successive moult over a period of five years, until the animals grew to resemble the type of lion usually found in the more humid Victoria Nyanza district.

Lions are also a good case in point for studying anatomical changes that occur in captive animals. Mammalogists have discovered that predatory animals accustomed to hunting and killing their food, exhibit certain muscular deterioration and changes in the bone structure when growing up in captivity. It was found that if a lion cub was reared in the zoo, his skull developed differently from that of his wild brother. This was due to the fact that the zoo lion was fed on killed meat and had little opportunity to use the tearing and rending muscles in the neck and jaws which exert a formative pressure on the skull of the wild lion.

"However," Mr. Carter continued, "when the general conditions of zoo life as well as the climate correspond more closely to the animal's natural environment, he is not likely to show any marked changes, so that it is not impossible to discover certain types of zoo animals that are quite acceptable for exhibition purposes. But the fact remains that we have been fortunate to secure sufficient wild specimens of most types and consequently, the zoo animal is being shoved more and more into the background."

"And by the background, you mean the study collections?"

"Precisely. And, of course, from the point of view of scientific investigation, they can do more good there than they can out in the display case."

Mr. Carter proceeded to tell about a few of the more noteworthy of the zoo's gifts. There was the story of the three little bears; not the familiar nursery tale, but an account of how a full grown bear's carelessness contributed three valuable specimens to the mammalogy laboratory. Three baby bears were killed the same day they were born when an older bear inadverdently rolled on them. And although the weights and dimensions of day-old black bear cubs were known, the department had never been able to secure specimens of that early stage in bear life. The three bears are now pickled in alcohol at the Museum while a fourth bear (a brother who escaped the mauling) has grown up to be a frisky and popular denizen of the Central Park Zoo. The latter while alive is just another black bear to the scientists, whereas the premature death of his three brothers has contributed to the progress of their work.

For half a century the zoos have been supplying the Museum with specimens, both common and rare. Of the latter type the most recent acquisition by the mammalogists was a pair of solenodons—large insectivores from Cuba of which the Museum had previously been able to secure only a few specimens.

"But this arrangement is not as one-sided as I may have made it seem," said Mr. Carter. "We manage to repay the zoo somewhat by giving them a good many live animals taken on our expeditions. For instance, I seldom go out but what I bring them something—usually birds."

"Birds?" Your Explorer raised his eyebrows.

"Yes, birds," came the reply. "They're a side interest of mine." The mammalogist with a partiality for birds relapsed into silence and once more began to stare thoughtfully out of the window.

Your Explorer quietly left him and made his way back to his base camp. As he passed the third floor, he paid another visit to John Daniel. The celebrated primate, he reflected, would always be remembered for the amazing story of his life, but now added to that was his latest claim to fame—the fact of his being the zoo's only remaining representative among the Museum's exhibits. And it seemed to this writer as he took his leave of John Daniel that the zoo could have chosen no worthier animal.

D. R. Barton.

YOUR NEW BOOKS—*Behind the Scenes at the Zoo—Sweet Medicine—Advancing Front of Science—Life of a Quail—Making of a Scientist—Concord River—A New Natural History*

WILD ANIMAL WORLD. Behind the Scenes at the Zoo

by Raymond L. Ditmars and William Bridges

Appleton-Century Book, $3.00

ZOOLOGICAL PARKS have always interested great numbers of people. Most of us gaze at the vast array of strange creatures gathered from all parts of the earth, little realizing what goes on behind the scenes, first in the capture, and later in the housing and feeding of all these different forms. Fortunately, for those interested, Dr. Raymond L. Ditmars has the opportunity of observing and the faculty for telling in a most interesting and entertaining manner much that goes on behind the scenes at the New York Zoological Park.

In *Wild Animal World* Dr. Ditmars and his co-author, Mr. William Bridges, first explain the manner in which many of these animals find their way to the zoos. A large portion are purchased through dealers. These dealers either personally visit sections of the country which are inhabited by the desired animals, or in the case of larger establishments, have special agents in the field. In Dr. Ditmars' words "the reader may surmise safaris, and visualize processions of natives laden with cages, nets and various trapping devices, but such expeditions exist largely in imagination. They would be far too costly to be practical and to yield a profit." Instead of this cumbersome paraphernalia, the agent's equipment consists of a liberal amount of cash. He makes his wants known to native hunters, and has the desired animals brought in to him.

Other animals that find their way to the zoo are family pets that have outgrown their usefulness as such. A whole chapter is devoted to a lion which began life as a household pet in Palisade Park, New Jersey.

The second chapter of the book deals with the feeding of the zoo animals. The public has little conception of the vast quantities of food that the 2500 inmates of the New York Zoological Park consume. Among the numerous items on a year's menu are: 1350 bunches of bananas, 20½ tons of bread, 220 pounds of ant eggs, 51½ tons of beef, 31,200 hen eggs, 290 tons of hay. There are over one hundred and fifty kinds of food used.

The New York Zoological Park also maintains a combined hospital and research laboratory, with a fully equipped operating room and cages for ailing animals.

Two chapters are devoted to the exploding of the many myths such as the mother snake's habit of swallowing her young. A list of fifty-four other misbeliefs and superstitions are mentioned and the possible source is explained.

Wild Animal World is a very readable book, well illustrated with photographs of some of the inhabitants of the Zoological Park.

T. DONALD CARTER.

SWEET MEDICINE

- - - - - - - - - - - - by Richard W. Randolph

The Caxton Printers, Ltd., Caldwell, Idaho, $2.50

THE mythology of non-writing peoples is their literature and is treasured by them for the same reasons that we find satisfaction in the classic examples of written literature. The narratives of the American Indians have always been popular because there are literary gems among them. We must remember that every classic is adjusted to the language in which it is composed and that the translation of it into another form of speech destroys most of the inherent beauty of the narrative. The plot can be carried over successfully, but rarely the form. This book gives English translations, presumably based upon the oral rendering of an interpreter, in the usual way in which such narratives are obtained. Since even the original Indian narrators vary their style and the interpreters offer but an approximate rendering in English, comparing the stories collected by one person with those of another always show great differences, even when gathered from the same tribe.

To the reviewer the plots in these stories seem Indian, but often the details appear bungled. Readers of Indian lore know how the best tales are found among many tribes ranging from the Atlantic to the Rocky Mountains, but in such variant form that exact parallels are rare. Such persons will find in these pages many familiar incidents and plot units in unexpected settings and sometimes so oriented as to seem a little weird. Yet, the narratives reflect an Indian background, even though presented in a free, sketchy way, and so are recommended to the reader interested in such tales. The illustrations are inferior and in many respects forbidding, since they depict the Indian in a crude, unreal fashion.

CLARK WISSLER.

THE ADVANCING FRONT OF SCIENCE

- - - - - - - - - - - - - - by George W. Gray

Whittlesey House, $3.00

IT is always somewhat difficult not to sound over-enthusiastic about the writings of George W. Gray. And for good reason. This man, whose name appears more or less regularly as a contributor to such magazines as

Harper's, The Atlantic Monthly, The New York Times Magazine and *The Yale Review*, shows positive genius in story-telling—the story-telling of science. He must have, as well, a genius for human relationships, for he has again and again persuaded busy scientists, among them the greatest of the world, men who value their time as their lives, to guide him down the long labyrinths of their secrets and their problems, and to confide to him their hopes for their work in the long look ahead.

Mr. Gray's book, *New World Picture*, which was published in 1936, was without doubt one of the clearest and most stimulating interpretations ever written about the universe as we know it today. There he gave us the background for an understanding of the new discoveries of the scientific world as it is now moving on, day by day, and almost hour by hour. In his new book, *The Advancing Front of Science*, Mr. Gray brings us up to date on the developments of today. Perhaps his own words in his Preface explain most clearly what he has done:

"The present book is an attempt to report news rather than to summarize history. It is an account of certain current advances in representative fields of science, of things lately turned up in the skies, in the atoms and molecules, in the living matter of cells and tissues—findings and intimations which are providing the basis for further advances, for reinterpretations, for the new world view of tomorrow."

The book is a series of brilliantly written essays (eighteen in all) dealing with subjects apparently as far removed from each other as the consideration of the reinterpretation of the meaning of the famous red shift, and an explanation of the quite unbelievable machines which record in graph fashion the processes of thinking. Do you want to know what are the chances that the individuals of the human race will in time succeed in lengthening the span of their stay upon the earth? What do you know about the latest developments concerning the cosmic rays? What about the most recent developments concerning the ionosphere and radio advance?

In *The Advancing Front of Science* you will find the answers to the questions raised in your mind by newspaper and magazine discussion of these thrilling new discoveries of today, which are to make the world of tomorrow.

The Scientific Book Club has succumbed to the inevitable, and has announced *The Advancing Front of Science* as its September selection.

MARIAN LOCKWOOD.

CROOKED-BILL, THE LIFE OF A QUAIL

- - - - - - - - - - - - - - - by I. H. Johnston

Dorrance and Company, $2.00

THE story of Crooked-bill is based primarily on a male Quail, or Bob-white, which had an actual existence at "Bird Haven," South Hills, Charleston, West Virginia, and with which the author was, at least for a time, acquainted. He was one of a brood of young hatched under a bantam hen after the nest was exposed by a mowing machine and deserted by the parents. Hence, for the early part of his life, he was under direct observation, and the part of the story dealing with this period is, we are told, an actual record of fact. Eventually, however he responded to the natural call of his wild brethren and in time, presumably, ceased to be a dooryard pet. To continue the account through this later period, the author has drawn on his knowledge and observations of many Bob-whites in West Virginia and has produced a composite picture of Bob-white existence for the supposed adventures of the hero of the story. Since this is admitted at the beginning of the book, there need be no criticism of the procedure.

It is less satisfactory to find all the animals humanized almost to the fullest extent, stopping short only at the line of interchange of conversation between them and the human characters. The assignment of human emotions and reasoning powers at once places the book on a juvenile level which it is not certain was intended by the author. It also serves to confuse the reader who may not be able to distinguish between fact and fiction and who is likely either to discard some of the truth or, more unfortunately, to accept some of the imaginative statements as reliable. This is regrettable because there is some very good natural history throughout the story. The author undoubtedly is very familiar with the fauna and flora of his region and some of his brief word-sketches of the different species are pleasing and effective. If the young reader could be told where to draw the lines between imagination and reality, he could absorb considerable trustworthy information relating to the wild life of West Virginia from these pages. Better still would it have been, from this point of view, if the author had presented his story in a way that would not have needed embellishment of this nature.

There is an evident intention to give a highly sympathetic account of the perilous existence led by one of our most friendly species of game birds, even in places where it is given some measure of protection, and in this the author has been quite successful. If the book arouses interest in bird protection or in the general study of natural history, it will have served a useful purpose.

J. T. Z.

LEICA MANUAL

- - - - - - - - - - by Willard D. Morgan and Henry M. Lester

Morgan & Lester Publishers, $4.00

THE new and extensively revised edition of the Leica Manual is probably the photographer's most effective springboard to the rapidly broadening arts of miniature camera photography. It is the Baedeker of the photographic explorer, carrying him from the microscopic to the telescopic and through the variant phases such as color, three dimensions, and beyond the limits of the visible spectrum.

Scientific and industrial applications of photography are copious and ten entirely new chapters have been added to this one-volume library of miniature photography. Especially noteworthy are those on Natural Color Photography by Henry M. Lester, and Education Through the Eye by Roy E. Stryker and Edwin Lock of the U. S. Resettlement Administration. Charles E. Breasted's chapter on archaeology and exploration tells a fascinating story of the function of photography in the exploration of historic civilizations. This chapter like many others in the book will do much to facilitate the adoption of up-to-date photographic methods in scientific projects.

This is a day of highly specialized photographic pursuits and the book, written in a conspicuously practical and interesting fashion, contains technical information which will suit the most exacting specialist. But the hobbyist as well can scarcely afford to close his eyes to the new avenues which this book opens up. It will increase the enjoyment and value of his camera many-fold.

E. M. W.

AFRICA AND CHRISTIANITY

- - - - - - - - - - - by Diedrich Westermann

Oxford University Press, $2.25

THE author of this book heads the celebrated International Institute of African Languages and Cultures, and is in his own right competent to speak upon the subject. He offers the reader a serious, thoughtful book, giving on the one hand an insight into the mind of native Africa and on the other what Christianity has done and promises to do for Africa. Those, who in off-hand fashion condemn all missionary activities should read this volume open-mindedly for what seems a fair statement of facts and events. First, the reader is shown how the idea of a high, all-good God is common to pagan Africa; hence, Christianity and Pagan Africa had something in common, a good starting point for the missionary. Again, the data indicate that the African looks upon Christian civilization as desirable and proceeds to adopt what he can of it. His taking to it is in part spontaneous. He is coming to accept the ideals in Christianity as worth striving for and not to be rejected because many white men fail to realize them in full. Some ten million blacks are Christians among whom at least a minority feel that the world is worth saving, regardless of failures on the part of whites to realize a Christian world and in opposition to the tendency of many whites to ignore all religion. Since history presents examples of other peoples similarly inspired eventually overrunning the earth, what is happening in Africa may be significant.

Even the busy person can find time to get once around the African situation by a casual reading of this tiny volume.

CLARK WISSLER.

ECOLOGICAL ANIMAL GEOGRAPHY

- - - - by Richard Hess, W. C. Allee, and Karl P. Schmidt

John Wiley & Sons, Inc., $6.00

PREVIOUSLY the most outstanding contribution to the subject of ecological animal geography was by Professor Richard Hesse, whose work,* published in 1924, embodied the results of all earlier investigators and many of the author's personal observations and interpretations.

In their new book, *Ecological Animal Geography*, Allee and Schmidt present a translation and complete revision of Hesse's original text. They include all new material since 1924, omit portions with which they are not in agreement, totally revise parts especially familiar to them, and very wisely eliminate all Lamarckian interpretations. Several other advantageous changes are the reduction of scientific names and technical terms, the use of American examples, and an emphasis of ocean stability. The theory of marked climatic variation in the past is also stressed.

Throughout this magnificent and unique work, animal ecology is considered strictly from a geographic point of view. The admirable treatment of ecological problems on a world-wide basis is employed.

In presenting this vast subject, the authors use the acceptable method of dividing it into a series of parts. The first of these deals with the ecological foundations of zoögeography. Here the problems of conditions of existence, effect of environment, distributional barriers, isolation, range, and biotopes are set forth. Part two is assigned to the distribution of marine animals. Physical and chemical conditions with their influence on animal life are pointed out, and the biotic divisions of the ocean are discussed separately. This treatment is especially thorough—including even such subjects as the theories of atoll origin. The distribution of animals in inland waters constitutes the third part and includes a consideration of not only environmental factors but of nearly every conceivable habitat. The final and more extensive part is devoted to the distribution of land animals. First the ecological factors of the land are discussed, and the remaining chapters deal with the various terrestrial habitats. The final chapter is an appropriate discourse on the subject of man's effect on the distribution of other animals.

Ecological Animal Geography is a brilliant contribution to science. It contains an enormous wealth of valuable assembled and original scientific information but dealing with so extensive a subject, occasional generalities, of course, are unavoidable.

That this book will be invaluable to all zoölogists seems certain. It ought to be an inspiration to the paleontologists, particularly to those invertebrate workers who are prone to regard their little fossil shells as just so many peanuts—of value as horizon markers and nothing more.

**Tiergeographie auf Oekologischer Grundlage.*

ERICH M. SCHLAIKJER.

THE MAKING OF A SCIENTIST

- - - - - - - - - - - - - by Raymond L. Ditmars

The Macmillan Company, $2.75

IN this volume Dr. Ditmars has presented a series of somewhat disconnected incidents of his life, beginning with a boyhood escapade of introducing a four-foot watersnake into the family apartment and closing with a hunt last year in Trinidad for a rare frog. There is no attempt at continuity since the episodes are often unrelated. There is a certain sequence, showing the main lines of the author's career after he first determined to take up natural history as a profession in spite of early parental opposition, although the story is far from complete considered as an autobiography, which, obviously, it is not intended to be. The numerous discussions and digressions show the varied interests which have employed the author's time throughout his life, not all of which are closely related to his profession. Studies of storms and the construction of meteorological instruments, investigations into the history and the battlefields of the Civil War, elaboration of radio broadcasts, bacteriological researches, performance of repairs to automobile engines, and similar activities and diversions are casually mentioned or discussed in detail as the occasion warrants. The main course of the narrative, however, deals with the author's experiences in the field or in the zoo.

Very little of the text is controversial, although an occasional statement is made which may be questioned. It is very doubtful if the distributional movement of animals is "usually actuated by the sense of leaving common enemies behind." The presence of efficient enemies is much more likely to effect the destruction of resident populations, while normal expansion under favorable conditions will produce the necessity for lateral movement. Also, it is debatable whether new insular species are produced because of forced change in habits and because of new terrain and food. Simple isolation of slightly diverse strains in very similar terrain may produce distinct forms but the rôle of external stimuli in the play of evolution is by no means established. Again, the reader is left in doubt as to the author's acceptance or dismissal of the recently revived (but actually very ancient) tale of the migration of certain of the smaller species of birds as passengers on the backs of larger ones, although he admits that he found a lack of support for the theory by his ornithological associates. The tale probably originated in the dim past when some movement of the larger birds was common knowledge but the seasonal disappearance of the more insignificant species was still a mystery. Needless to say there is no factual support for the theory.

However, these discrepancies are not likely to interfere with the general reader's enjoyment of the book. The volume is entertaining and may be recommended to readers who have a taste for natural history or to those who may wonder what a naturalist finds to do in his spare time as well as in the course of his official duties.

CONCORD RIVER

- - - - - - - - - - - - - by William Brewster

Harvard University Press, $3.50

THE cordial reception given *October Farm*[1] has induced those in authority to issue a second installment of William Brewster's *Concord Journal.* It covers the years 1879 to 1918 and, like the first, was made by Brewster's Concord friend, Reverend Smith Owen Dexter. As far as text is concerned, the present volume, therefore, is similar in nature to the first. By the addition of twelve Benson drawings the publishers have made it more beautiful, but, in our opinion, format and content are less in accord then in *October Farm.*

No one, we believe, would have been more surprised by the enthusiastic greeting given *October Farm* than Brewster himself. The journal from which, with the present volume, it was taken is exactly what it pretends to be, the daily record of a field ornithologist, designed to place on file what he saw, rather than what he thought. All serious bird students keep, in essence, similar memoranda of their observations. But Brewster did nothing half way. Everything that he accomplished represented his best. The simplicity of Brewster's writing is the result not merely of keen vision, clear thinking and good taste but of an intensive study of grammatical laws.

Revealing his own method he once wrote a friend: "Compare what you write with the rules of your favorite authority on grammar." As further evidence of his own standards he closed an important review with the words, the author "has yet to learn that the simplest English is the strongest and best" (B. N. O. C. 1883).

It was Brewster's ambition to produce a comprehensive work on the birds of New England. His journals were the foundation on which this great undertaking was to rest. They were not written for publication but as storehouses to supply material for the final work. Hence they contain little or no comment, criticism or discussion but are made up chiefly of direct, objective entries of each day's experiences afield. Facts were filed for future reference and as a part of the season's history. This daily task, as we recall it, Brewster performed easily and, on occasion, when surrounded by talking companions.

Writing for publication was a very different matter. "I do not write," Brewster once said, "I piece words together."

With the passing of the years, and possibly as his standards became higher, it became increasingly difficult for Brewster to prepare manuscript for the press. In the early nineties the plan for sole authorship of the New England book was abandoned, and it was decided to ask Frank Bolles to become a joint author of this work. Unfortunately, Bolles' death, in January, 1894, prevented this proposed cooperation. The completed memoir on the birds of Cambridge[2] and work on the birds of the Umbagog Region,[3] therefore, took the place of the monograph of New England birds.

Because Brewster lived at Concord, uninformed reviewers compare his work with that of Thoreau. In his Foreword to *Concord River* Dr. Thomas Barbour effectively shows how little ground there is for this comparison.

Brewster was a professional ornithologist; he was the leading authority on the birds of New England, and in the first rank of American bird students. A careful, accurate observer, his final identification of the living bird was never questioned. He collected thousands of specimens, prepared them with exceptional skill, and erected at his Cambridge home a model museum for their reception. In time, he assembled here the largest private collection of birds in this country.

Because of the extent of the facilities offered students, but more particularly because of the hospitality of its owner, Brewster's Museum became the focal point for bird lovers in New England. Here the Nuttall Club, of which Brewster was a founder and long-time president, held its bi-weekly meetings; here the American Ornithologists' Union, on the occasion of its Cambridge conventions, held its Council meetings; here, at all times Brewster was an inspiration to seekers for bird-lore.

Compare this sketch with the popular conception of Thoreau and it will be seen that the two men were no more alike than white pine and pepperidge.

FRANK M. CHAPMAN.

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[1] For a review of "October Farm," the first installment, see NATURAL HISTORY for January, 1937.

[2] Mem. Nutt. Orn. Cl. IV, 1906.

[3] Bull. Mus. Comp. Zoöl. LXVI, 1924; LXVI, 1925.

NATURAL HISTORY

- - - - - - - - Edited by Charles Tate Regan

Hillman-Curl, Inc., $6.00

THIS *Natural History* is a descriptive survey of the animal life of the world, a very large field to cover in even so considerable a volume (896 pages).

It differs in several respects from comparable standard natural histories of the last generation. Its materials are more definitely classified and arranged in such technical groups as phyla, orders and families. The text relating to various major groups as insects, fishes, birds, mammals, is written in each case by a specialist on that group. It is much more profusely illustrated, especially with photographs (there being 16 color-plates and over 1,000 text-figures).

The higher animals are principally considered in this book, as only about one-fifth of its pages are given over to the lower animals or invertebrates, which (including the insects) make up the great bulk of animal forms known. However, considering this very limited space allotted to them, the most interesting lower forms of life seem to have been ably reviewed. The numerous and varied class of fishes receive comprehensive and well balanced treatment, and are written of most interestingly, as one would have a right to expect from the editor's international reputation as a master of this subject. The selection of forms to illustrate the reptiles and amphibians has been a happy one. The photographs illustrating the chapter on birds are largely from nature and many of particular beauty. Birds in general are treated broadly, but numerous related species of small birds described and illustrated are predominantly British, so that as regards this phase of ornithology the book is somewhat insular. Photographs of mammals, on the other hand, largely from captive individuals, are of species from every part of the world including many peculiar forms. They also include a fine series of illustrations of the many antelopes, and of cats and civets.

One may criticize this excellent work as being somewhat disjointed and at times unbalanced. The great abundance of illustrations renders it very attractive, and these will also have no little reference value for the general naturalist. One or two only seem to have been misidentified, but it is too bad that immediate availability often seems to have influenced their selection. There are plenty of excellent photographs from nature extant of larger mammals which are illustrated from zoo specimens, and such would have brought the mammal section up to the general aesthetic standard of that dealing with birds. But even in that section the same criticism holds. For instance the good idea of illustrating one species of the highly colored foliage-haunting American tanagers is vitiated by the use of a wretched figure of doubtless well-mounted birds. Figures of such notable mammals as a whale-bone whale, a manatee or dugong, and even of a little chief hare (or pika) might advantageously have replaced some of those used. The book is one that is well worth having, and almost anyone should find pleasure and profit in its perusal.

J. T. N.

THE SOCIAL PARASITISM OF THE CUCKOOS*

- - - - - - - - - - by Wolfgang Makatsch

Leipzig; Quelle & Meyer, 1937

FEW habits of birds found such early attention of the naturalists as the custom of the cuckoo to place its eggs into the nest of other birds and to let them take care of his offspring. The literature on the subject, consisting of thousands of individual observations and countless theories as to the how and why, would fill many volumes, but there has been no recent attempt to sum up the entire evidence in a single volume. This gap the author tries to fill. He has accumulated a wealth of material, but the treatment is not always as critical as might be desired. The emphasis is on the common cuckoo (*Cuculus canorus*) and its habits in Central Europe, but the Asiatic and tropical species are also discussed, as well as the occurrence of social parasitism in other families of birds.

E. M.

* *Der Brutparasitismus der Kuckucksvogel*

MAN IN A CHEMICAL WORLD

- - - - - - - - - - - by A. Cressy Morrison

Charles Scribner's Sons, $3.00

IN 1935 when the American Chemical Society celebrated the three hundredth anniversary of the founding of the chemical industries in America, it was decided to present, in the form of a book, for the general public, and for the scholar and technician, a record of the outstanding achievements of chemical industry. This undertaking has been superbly realized in A. Cressy Morrison's *Man in a Chemical World.*

The book is delightfully written. Apart from its popular presentation it is teeming with a countless number of astonishing facts concerning chemistry and its place in man's everyday existence. Beginning with a brief account of the origin of the earth and the elements of which it is composed, the author discusses the origin of life and its development in this chemical world and points out that man himself is "animated chemistry." He then proceeds, in some three hundred pages, to show how essential the products of chemical industry are to our existence, and emphasizes the service that that industry renders to civilization. The reader is convincingly informed that this service includes: employment of millions; production of more, better, and safer foods; development of safer and faster transportation; manufacture of all those products on which our comfort so thoroughly depends; supply of invaluable materials to all other branches of industry; and establishment of greater security in peace and in war. A whole chapter is devoted to the subject of "Keeping Well" in which the fact is stressed that prevention of disease, alleviation of suffering, and cure by medicines are achievements of chemical industry. This chapter alone is sufficient to impress the reader how utterly dependent he is on chemistry—the main purpose of the book. In the last chapter, the author gives an inspiring prophesy of the future rôle of the industry. The book is closed with an impressive *L'Envoi* which reminds the reader that the very materials used in writing and publication of the book itself were almost wholly chemical!

The illustrations are not numerous. They are comprised of no more than two dozen drawings which are striking and realistic portrayals of the chapter contents, plus a few pictorial statistics.

In this review of the achievements of a great industry, Mr. Morrison has written what everyone should read.

ERICH M. SCHLAIKJER.

SCIENCE IN THE FIELD AND IN THE LABORATORY

—*Art and Tools of Prehistoric Europe—Live Lizards from South America—Return from Shiva—November Lectures*

The Tools and Art of Early Man

Specimens of the tools by which early man lived, the weapons with which he fought, and the basic art forms he created in his leisure moments have at last been sorted and arranged into chronological order by the Anthropology Department. The result of this monumental achievement—the accurate identification of 20,000 separate specimens unearthed from all the principal European countries except Poland and certain of the Balkan states—is an exhibition showing the entire developmental history of the arts and industries of Ancient European Man.

The collection is especially rich in the art forms of early Stone Age France, and in relics of the latter Stone Age, Iron and Bronze periods in Switzerland and Denmark. Ireland, England, Sweden, Germany, Belgium, Spain, Hungary and Greece are fairly well represented; but completeness is yet to be attained with respect to most other European countries.

Filling an important gap in the industrial series of the collection is a new aquisition bought in 1931 and numbering about 3,000 specimens, from western Brandenburg (the province of central Germany in which Berlin is situated). This purchase was made possible through the Frederick G. Voss Fund. The Museum was extremely fortunate to get this collection which contains specimens of several chronological periods not represented in the Museum's assortment. Two major Museum expeditions had tried to secure relics of these periods and had been unable to do so in sufficient numbers.

Mr. Max Schneider of Berlin from whom the collection was purchased, obtained the material from 150 different sites by surface picking and excavations extending over a period of sixteen years. Some of the region in which he did his work has been preserved for archaeological research largely because it is wasteland consisting of sand dunes and bog holes partly filled with peat.

The Mesolithic hunters arrived here about 10,000 B. C., or as soon after the glacial retreat as the country became habitable, and their implements are now found partly buried in both the dune and bog formations. The specimens themselves, aside from a number of animal bones including the deer and the horse, consist mostly of flint objects. The collector indeed claims this Brandenburg pottery to be the oldest in the world! However that may be, the addition of this collection to our series makes it possible at last to illustrate all the principal steps in the European story of cultural evolution.

New South American Lizard Collection

More than a hundred specimens of iguanid lizards collected in British Guiana by the Holden-British Guiana Expedition have joined the group of living fish, reptiles and amphibians whose behavior is being studied by Dr. G. Kingsley Noble, Curator of the American Museum of Natural History's department of Experimental Biology, in connection with his biological research. The specimens were sent to the Museum by Mr. Robert Snedigar of the Herpetology Department and member of the expedition who is engaged in collecting reptiles and amphibians.

Very little is known in regard to the life history or social behavior of reptiles. This is chiefly because of the difficulty of keeping them alive in our northern climates. Lizards for the most part require a considerable amount of direct sunshine and this is not available to them in most of the zoos of this country. The biological laboratories of the Museum are equipped with greenhouses fitted with Helioglass. This glass transmits a considerable amount of ultra-violet light—the chief requirement of the tropical lizards. A series of screened cages provided with luxuriant tropical plants will permit these lizards to live and breed in the Museum laboratories. It is planned that laboratory observation will supplement the work being done in the field by the Holden Expedition.

Return from Shiva's Temple

The celebrated Grand Canyon Expedition has returned from the field and a narrative account of the field work may be expected in an early number of NATURAL HISTORY.

The party assembled on the South Rim of the Grand Canyon on Sept. 11th, and on the 15th of the month began the ascent of Shiva's Temple. Dr. H. E. Anthony, Curator of the Department of Mammals, who was in charge of the expedition, spent some ten days on the top of this isolated plateau where he was assisted by George B. Andrews, the son of Director Roy C. Andrews. A collection of 75 specimens of mammals was brought back to the Museum and will be studied to see what, if any, effects of isolation have been expressed in the characters of these mammals.

Because of the difficulties expected in getting to the top of Shiva's Temple and the similar mesa known as Wotan's Throne, the American Museum secured the cooperation of the American Geographical Society, who permitted Mr. Walter A. Wood, Jr., to accompany the party, in charge of mountain climbing. Mr. Wood was able to get the collecting party on to the top of Shiva without any great difficulty and then he departed to land supplies of water and provisions by means of parachutes. Miss Amy Andrews, who generously volunteered the use of her airplane for the work, flew Mr. Wood over the Temple, and water and food supplies were dropped by parachutes.

After the camp had been successfully established on Shiva, Mr. Wood took the climbing party on a successful ascent of Wotan's Throne which was much more difficult. Upon returning from this undertaking he advised against the attempt to maintain a collecting party there at this time because packers would scarcely be able to carry water and food up the cliffs, and the forest on the top appeared to be too heavy for the practical use of parachutes. Furthermore, it appeared advisable to study the specimens collected on Shiva before undertaking the more extended operations necessary to make a biological survey on the top of Wotan's Throne. Accordingly, the personnel disbanded and left the Grand Canyon by the 29th of September.

Honors and Awards

Mr. Van Campen Heilner, Field Representative of the Department of Ichthyology, received on Monday, October 11th, the highest decoration given by the Cuban government. This is the order of Carlos Manuel de Cespedes. It is to be conferred upon Mr. Heilner in recognition of his long friendship for Cuba and his activities in bringing this country to the foreground of attention for scientists and sportsmen.

Flower Show

The annual Flower Show of the Horticultural Society of New York will be held in Education Hall of the Museum on November 5th, 6th and 7th.

* * *

From November 10th to 30th an attractive display of the art work of high school students of the city will be on view in Education Hall.

Recent Museum Publications

NOVITATES

No. 940. Additions to the Upper Paleocene Fauna of the Crazy Mountain Field. By George Gaylord Simpson.

941. New South American Syrphidae (Diptera). By C. L. Fluke, Jr.

942. An Early Pleistocene Fauna from Nebraska. By Erwin H. Barbour and C. Bertrand Schultz.

943. A New Jurassic Mammal. By George Gaylord Simpson.

944. An Albino Tarpon, *Tarpon Atlanticus*, the Only Known Specimen. By E. W. Gudger.

945. A Glut Herring, *Pomolobus Aestivalis*, with an Attached Colonial Hydroid *Obelia Commensuralis*. By E. W. Gudger.

946. On the Palate, Occiput and Hind Foot of *Bauria Cynops* Broom. By R. Broom.

947. Birds Collected During the Whitney South Sea Expedition. XXXVI. Notes on New Guinea Birds. III. By Ernst Mayr.

948. Bees Collected in Arizona and California in the Spring of 1937. By T. D. A. Cockerell.

949. Siberian Bees of the Genera *Halictus*, *Sphecodes* and *Hylaeus*. By T. D. A. Cockerell.

950. Bees of the Genera *Halictus* and *Ceratina* from Siam. By T. D. A. Cockerell.

951. A New Primate from the Upper Eocene Pondaung Formation of Burma. By Edwin H. Colbert.

952. The Comparative Osteology of the Swordfish (*Xiphias*) and the Sailfish (*Istiophorus*). By William K. Gregory and G. Miles Conrad.

953. More Complete Remains of a Chelonian, *Syllomus Crispatus* Cope, from the Miocene of Virginia. By Charles T. Berry.

"Music of the Spheres" Broadcast

Miss Marion Lockwood of the Planetarium staff will give weekly recitals of Nature poetry every Wednesday at 3:45 over Station WQXR. Some of the Planetarium's most popular recorded music will also be heard.

Visits of Crippled Children

Regular visits to the Museum for the crippled children of New York City public schools have been arranged for the third Thursdays of each month throughout the school year. About forty children will come on each trip in buses for programs especially planned to supplement their school work. Illustrated lectures and tours of the Museum halls will be followed by luncheon and attendance at the one o'clock planetarium show, which is free to school children. Miss Lee, in charge of crippled children, is cooperating in these arrangements.

Planetarium Notes

During the month of November, the performances in the Hayden Planetarium will have to do with the "Secrets of the Sun—Our Day-Time Star." The nature of the sun as a stellar body, the meaning of sun-spots, the influence of the sun upon the earth and upon mankind, are among the points that will be taken up in this lecture.

* * *

A newly acquired loan painting has been hung in the Planetarium on the second floor. It is a picture of Galileo in prison, by G. A. Hessl.

* * *

During November the Amateur Astronomers Association is holding two meetings as usual, in the Lecture Hall of the Roosevelt Memorial, on Wednesday evening at 8:15. Anyone interested is invited to attend.

November 3—Mr. John L. Wallace, Crafts Director, The Edgewood School, "The Edgewood Observatory"

November 17—Mr. Alfred Africano, President, American Rocket Society, "Rocket Trips Into Space"

The classes of the Amateur Astronomers Association are open now to members of the American Museum of Natural History. For further information address Mr. Charles A. Federer, Jr., Secretary, Amateur Astronomers Association, American Museum of Natural History.

* * *

The Junior Astronomy Club holds its meetings on Saturdays at 8:00 p.m., in the Lecture Hall of the Roosevelt Memorial Wing. These meetings are open to the public.

November 6—Captain J. F. Hellweg, Superintendent, U. S. Naval Observatory "Canton Island Eclipse Expedition"

November 20—Harold E. Levenson, President, Junior Astronomy Club "The Magic of the Spectroscope"

Eskimo Collection Presented

During her incumbency as United States Minister to Denmark, Ruth Bryan Owen (Mrs. Borge Rohde) made an extensive journey to the various settlements in Greenland. She recently presented to the Department of Anthropology, an ethnological collection from the Eskimo of East and West Greenland, gathered during that trip. The collection is particularly interesting because it demonstrates so well the effect of generations of white contact on Eskimo costume, tools, and utensils, as well as on technological skills, many of which, although transferred to new forms or materials, have lost none of their excellence in the transfer. Thus, the old method of fur decorations made up of tiny squares of fur arranged in geometric patterns has been carried over to robes and pillows of European style made of large squares of fur, though variants of the older fur decorations are still applied to clothing. Again, the woman's costume, though closely following the old pattern, is a curious conglomeration of cotton cloth, fur, leather, and beads, and sometimes even crocheted lace. Their adeptness in carving in wood, stone, and ivory is shown in a series of carved driftwood figures, figures and sleds carved in walrus ivory, and various objects made of soapstone. Many of these carvings vividly depict the use of native tools as well as occupations. Outstanding are the excellently and accurately made models of kayaks and a woman's boat, one of these being completely equipped for hunting and summer camping.

Calendar of November Lectures

November 4
8:15 P.M. Lecture to Members: HUNTING WITH A MICROPHONE by Dr. Arthur A. Allen

November 5
10:30 A.M. Lecture to Public School Children: FRANCE by Gladys L. Pratt

November 6
10:30 A.M. Lecture to Children of Members: TO PERU FOR THE ECLIPSE OF THE SUN by Dorothy A. Bennett
2:00 P.M. Free Motion Picture on DANIEL BOONE

November 9
8:15 P.M. Know Your Museum Meeting: THE BEGINNINGS OF LIFE by Dr. Wm. K. Gregory

November 12
10:30 A.M. Lecture to Public School Children: THE STORY OF TRANSPORTATION by Agnes K. Saunders

November 13
2:00 P.M. Free Motion Picture on FOSSIL HUNTING IN THE GOBI

November 16
3:50 P.M. Biology and General Science Lecture: CONSERVATION OF OUR WILD LIFE by Paul B. Mann

November 18
8:15 P.M. Lecture to Members: THE ECLIPSE IN PERU by Major Albert W. Stevens and Dr. Clyde Fisher

November 19
10:30 A.M. Lecture to Public School Children: IN THE DAYS OF PETER STUYVESANT by Grace F. Ramsey
7:00 P.M. Special Planetarium performance for Evening Elementary School Students Association

November 20
10:30 A.M. Lecture to Children of Members: THE INDIAN IN SONG AND STORY by Te Ata
2:00 P.M. Free Motion Picture: VINCENNES

November 23
3:50 P.M. Biology Lecture: RECENT ADVANCES IN BIOLOGY by Dr. G. K. Noble
8:15 P.M. Know Your Museum Meeting: ORIGIN AND EARLY EVOLUTION OF BACKBONED ANIMALS by Dr. Wm. K. Gregory

November 27
2:00 P. M. Free Motion Picture: THE PILGRIMS

APPLICATION FOR MEMBERSHIP IN

THE AMERICAN MUSEUM OF NATURAL HISTORY

Membership Secretary, The American Museum of Natural History
79th Street at Central Park West, New York, N. Y.

Please present my name to the Membership Committee for election as an Associate Member and find enclosed $3.00 covering dues for the next twelve months.

I understand that I am to receive NATURAL HISTORY MAGAZINE each month except during July and August, my members' card for admittance to the members room, my certificate of membership showing the date of my election.

NAME ....
PRINT
OCCUPATION ....
ADDRESS ....
CITY .... STATE ....

Cheques made payable to the Treasurer, AMERICAN MUSEUM OF NATURAL HISTORY
THE AMERICAN MUSEUM reserves the right to reject any application

RECENTLY ELECTED MEMBERS

THE following 1003 persons have been elected to membership in the American Museum of Natural History since the last issue of NATURAL HISTORY.

Sustaining Members

Messrs. George F. Hurd, Walter C. Teagle, Jr.

Annual Members

Mesdames Harrison Atwood, M. J. Breitenbach, Gifford Conway, H. S. Darlington, Bertran E. Goodman, Philip Rhinelander, 2nd, Frank M. Sheldon, Henry L. Stoddard, C. B. Townsend.

Mother M. Marie Therese

Sister Angelica.

Misses Elsie Brown Barnes, Eleanor C. Erving, Lillie Hamilton French, Dorothy Gordon, Katharine Lee, Bernice L. MacLean, Dorothy Meier, Sarah E. Olden, Bertha H. Schwarz, Florence H. Sibley, M. Hazel Van Dine.

Reverend W. J. Donohue.

General Samuel E. Tillman.

Captain David V. Shaw-Kennedy.

Doctors G. M. Babbitt, Leo F. Gieberich, Roland I. Grausman, O. E. McKim, Herbert E. McLean, Andrew H. Oeder, R. Townley Paton, Charles A. Perera, Arthur Prince, Benj. B. Rittenberg, William Snow, C. S. Taylor.

Messrs. Webster S. Achey, B. L. Allen, P. A. E. Armstrong, Frank A. Assmann, Lawrence Berg, Samuel Berliner, Jas. Madison Blackwell, John G. Bowman, George P. Brett, Jr., Walter F. Brown, Frank Buck, Richard H. Cardozo, Benno Cohen, Ronald M. Craigmyle, Charles C. Curtis, M. E. Dann, Alfred E. Drake, Carl Fisher, Frank R. Fitzpatrick, Robert Lee Forrest, Theodore P. Grosvenor, Albert Heymann, Lejaren A. Hiller, Jerome H. Hoffheimer, James W. Holler, Jr., C. Clarence Kaskel, Edward S. Litchfield, Walter W. Loercher, Harry E. Mack, Donald McDonald, Joseph P. McElroy, R. G. Noble, George A. Phelps, Louis S. Posner, G. Vernor Rogers, C. Bernard Shea, William Slater, Otto Soglow, F. LeRoy Spangler, Bryn Strandenaes, Nathaniel Thurlow, Kenneth Webb, William J. Weidman, Birkbeck Wilson, Douglas Rider Wilson, John M. Young.

Associate Members

Mesdames Grant Bunnell, Jr., Robert Carchrie, Robert W. Carter, Fernande Castelnau, A. N. Connett, Walter S. Coppage, E. O. Dustin, Adelaide P. Earle, C. M. F. Egel, Alfred Emerson, Ira Fink, H. Fisher, Samuel Fisher, David Fleming, Charles S. Fuller, Harlan Gannon, Milton M. Goldsmith, A. Gunn-Durham, Fred'k W. Harris, De Los L. Hill, J. D. Jacobs, E. W. S. Jasper, Carl King, Robert M. Levy, J. W. Loeb, Donald S. McClain, J. L. McCutcheon, Mark C. Meltzer, Jr., Zaida Metcalfe, Robert Miller, Marjorie C. Morley, Julliette C. Osterberg, Edith D. Ostertag, Thornton B. Penfield, Hugh Peters, T. J. Pickens, J. W. Riley, Mary A. Robbins, Elizabeth Rennult Rosa, L. Rosenheim, Alexander E. Salzman, Geo. Scholey, Jr., Mary H. Scott, William Searles, L. B. Skinner, Agnes E. Slate, Stephen Slesinger, Joseph P. Smyth, J. L. Steward, Frederick L. Strong, E. G. Trowbridge, Albert A. Volk, O. R. Washburn, Joseph L. White, Helen Wing, M. V. Yelverton, John Young.

Sister M. Auxentia.

Misses Octavia Blades, Dorothy Brockway, Lilian A. Burd, Catherine Chamberlain, Cecile Clarke, Florence N. Cleaver, Ruth Conner, Flora May Conover, Emma A. Cutter, Ruth Irene Deffley, I. C. Drake, Fannie S. Eanes, Elisabeth S. Edwards, Marjory Fleischer, Olga E. Fors, Miriam Friedman, Gertrude E. Fritz, Johanna Fritz, Carolyn S. Frizzell, Katherine Galloway, Eleanor R. Geissenhainer, Mary E. Gifford, Joelene Goodwin, Beatrice M. Graeb, Anne Grunder, Ora L. Hall, May A. Hansen, Anna Hasselman, Jennie Hedrick, Carolyn Henneberger, Lydia Herzfeld, Anna E. Hoke, Annie W. Holden, Hazel Holly, Laure Hoover, J. Elizabeth Hopkins, Nathalae Howe, P. A. Hurley, Sara T. Jackson, Katherine D. Johnson, Gwendolyn Jones, Sylvia M. Kangas, Alice G. Lapham, Dorothy M. La Salle, Julia Lenz, Edna A. Levy, Fannie E. Levy, Olive Arey Lewis, Anne Bush Mac Lear, Frances Manning, Eva Justine Monell, Imogene Moore, Margaret R. Motter, Etta Josephean Murfey, E. B. Novy, Beatrice J. Parish, Ruth Lee Parrott, Martha Doane Reid, I. W. Rose, Mary A. Russell, Bessie Sadovsky, Elise Harriett Schilt, Nettie Trexler Sellers, Minnie Serber, Grace E. Sexton, Florence A. Shook, Sarah A. Simpson, Isabelle Sloan, Ella W. Smith, Taisia Stadnichenko, Mary L. Swift, Grace A. Tillistrand, Elizabeth W. Toadvine, Loraine Ulman, K. Birch Voorhees, Jean F. Walter, Ruth M. Walter, Helen Mary Wattles, Barbara Weil, Florence Weinstock, Susan Williams, Eleanor E. Work.

Most Reverend M. S. Garriga.

Reverends Leo A. Allyson, Joseph S. Altany, Isaac F. Andrews, Carl J. Anthony, S. Arjonilla, Frederick S. Arnold, Albert C. Baker, J. Monroe Ball, James Bancroft, Robert Bell, Roger W. Bennett, E. M. Bernier, Robert A. Boelcke, R. M. Bradner, T. I. Bresnahan, Thomas J. Broderick, G. W. Buchholz, Jr., Vincent P. Burke, James A. Cassidy, John Lyon Caughey, Harold H. Clemans, Anthony C. Cogan, E. E. Colvin, John R. Coombs, Eugene J. Crawford, Charles Dana Crisman, Edgar Crossland, P. J. Cuny, C. C. Curran, F. J. Czelusta, A. J. Dallinger, T. Joseph Doyle, C. J. Eiselein, John J. Feeley, A. K. Frankoviz, A. Freeman, William L. Freund, Wm. C. Fromme, August F. Gearhard, John Goelz, C. F. Graves, Joseph E. Hanz, Rayford Harris, Edward M. Hartigan, J. F. Holland, M. K. Hollister, J. L. Howard, Philip C. Hughey, John H. Huhn, H. Jacquemin, J. Russell Jones, Leo A. Jones, Denis Kennedy, F. J. Kennedy, Thos. J. Kenney, R. A. Kielpinski, Harvey Klaer, John A. Klich, Theodore S. Klopotowski, H. H. Koppelmann, Anthony T. Kurzynowski, E. C. Lambert, Arthur Lamothe, Alfred Landry, Jas. F. Le Clere, Achille Lettre, Wm. P. Lockwood, James W. Lord, T. P. Lott, W. T. Mabon, Francis L. Markey, Alfred Mathieu, D. J. McCullough, Claude Allen McKay, Gratian Meyer, C. B. Miller, Joseph A.

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(Due to lack of space, names of members not listed here will be listed in the next issue)

THE INDIAN AND THE WHITE MAN'S BUFFALO

Continued from page 630

the best scientific thought and the work must be fast.

In pre-reservation days a woman was judged by the number and quality of skins she had dressed, the baskets she had woven, or the pottery moulded; and her renown for such accomplishments might travel far. When by chance you met a woman who had distinguished herself, it was proper to address her in a manner to reveal your knowledge of her reputation, as:

"Grandmother, we are happy to look upon one whose hands were always busy curing fine skins."

The reply might be: "Grandson, you see me now an old useless woman. Once these hands were strong and smooth, able to handle the heaviest skins. Many, many have they finished. There hangs my work-bag, but the tools are idle."

An old woman once gave me a skin scraper made of an elk antler. It was polished by much use and upon one side was a long row of marks indicating the number of skin tipis she had made single handed. A gold medal could scarcely match the significance of this relic of a heroic life.

One day I noticed an old woman sitting on the ground, striking at a deer skin in an unusual manner, and drawing closer I saw that her implement was a rude pebble with a scraping edge. So here we were transported back to the primitive days when the Indian woman used so simple a homemade tool to produce a buckskin as soft and durable as any in the age of steel.

"Grandmother, why do you use a stone?" I asked. She replied:

"Grandson, in the long ago our people had nothing but stones. Then the white man came with his sharp iron knife. These knives are better, but they often cut holes in the skin. Now I am old, my eyes are failing and my hand shakes; so I have gone back to stone. The ways of our fathers are still good ways."

I like to think of that courageous old soul as the symbol of the twilight of the Great West.

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Explorers, travelers and tourists who are camera enthusiasts usually carry two or more cameras on their photographic journeys. One camera to be used for black and white and another for color or color transparencies. A well known house offers a midget camera that may well fit in any budget. It is equipped with an F4.5 Anastigmat Lens and takes up to 1/100th of a second. People interested in acquiring a camera that will fill every need at a reasonable cost will find this a worthwhile offer.

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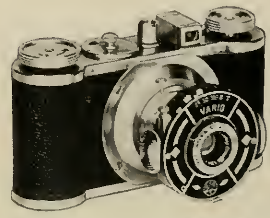

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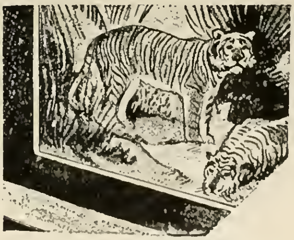

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AN ALBINO TARPON

Continued from page 652

In fishes records of albinism are not very common. In the *Bibliography of Fishes* there are definite records of 14 different kinds of albino fishes, but the tarpon is not among them. It is interesting just here to know that albino trout, often occurring in fish hatcheries, like albino rats, reproduce themselves. Such a race, however, is unusual. Perhaps albinos are seen more frequently among flatfishes than any other kind of fishes, probably because flounders, etc., are caught for food in such vast numbers, and being flat and broad, an albino form quickly catches the eye.

But never before has an albino silver king been seen by other eyes than the eyes of us interested in catching, mounting and exhibiting this specimen. The American Museum owes this unique specimen to the angling skill and to the generosity of a loyal member, Mrs. Olivia Erdmann Kuser. And if you, O! Reader of NATURAL HISTORY, believe, like the countryman of the giraffe, that "there ain't no such animal," then you are invited to come to the Natural History Museum and in its Hall of Fishes look on the west wall of the north end for a fish bearing the label

An Albino Tarpon

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THE ANCIENT ART OF BEAUTIFICATION

Continued from page 675

on men's and women's faces. When one country has been decided upon as the originator of a cosmetic, another and an older civilization is unearthed which demands recognition for having used that same cosmetic centuries before.

Throughout the thousands of years during which cosmetics have been in use, there have been only five reasons for applying them; to cleanse, to allay skin troubles, to cover up imperfections, to protect from the weather, and to beautify. The last use has been paramount everywhere; the cleansing function was a neglected point until comparatively recently.

Reasons for the use of cosmetics, as well as the cosmetics themselves, have changed very little since Queen Shub-ad's time. There is scarcely any beauty secret today which the ancients did not use. Like Queen Shub-ad of Ur, Queen Nefertiti of Egypt, Queen Poppaea of Rome, and Lady Sei Shonagun of Japan, the women of today have pomades, creams, perfumes, hair-bleaches and dyes, nail polishes, rouge, powder, mascara, and eyebrow pencil. Human decoration has found its outlet and expression in almost identical ways since the beginning of mankind. It is a small world, and there is very little new in the ancient art of beautification. As old Jonathan Swift said:

> "Vain humankind! Fantastic race!
> Thy varied follies who can trace?"

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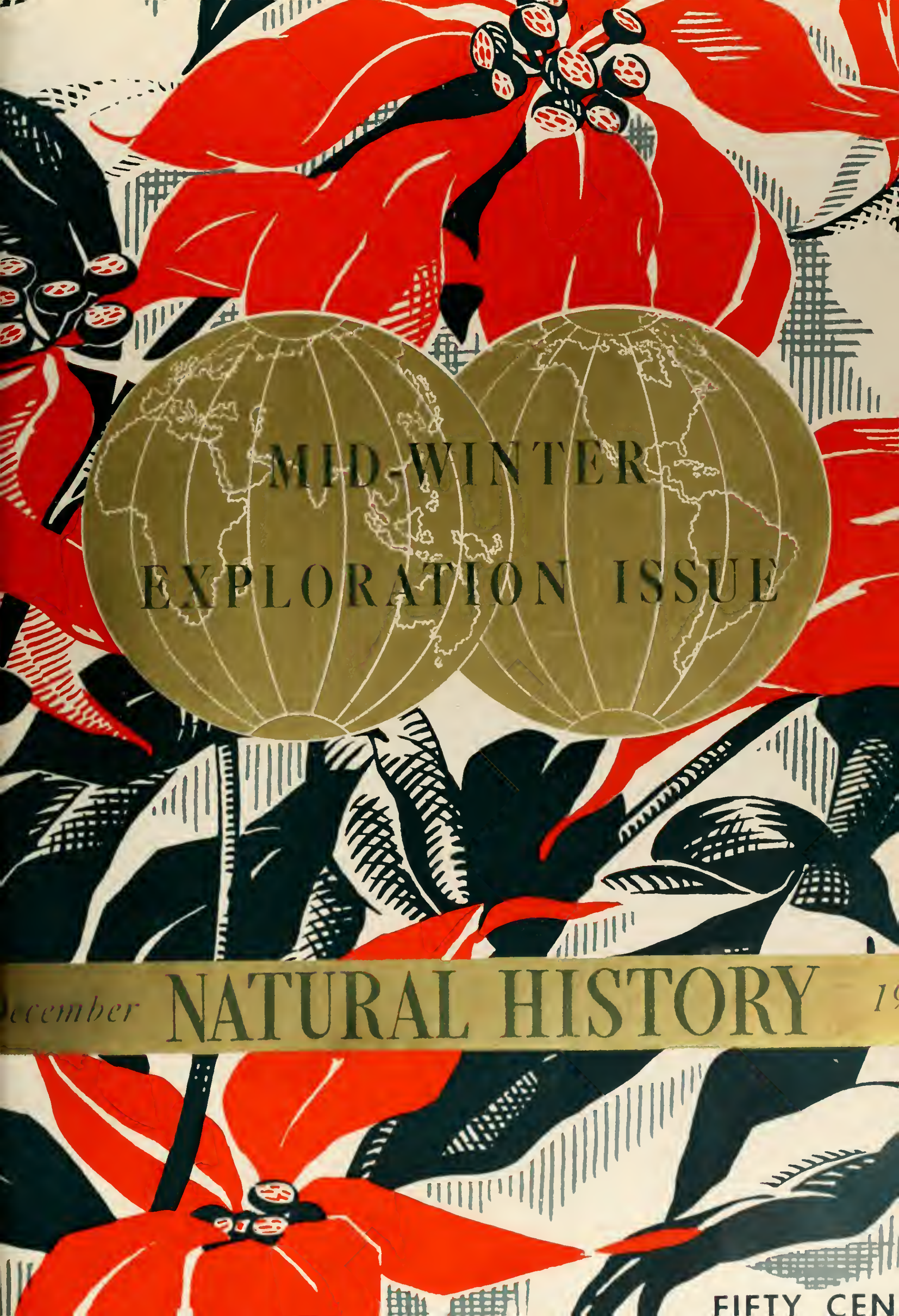

MID-WINTER EXPLORATION ISSUE

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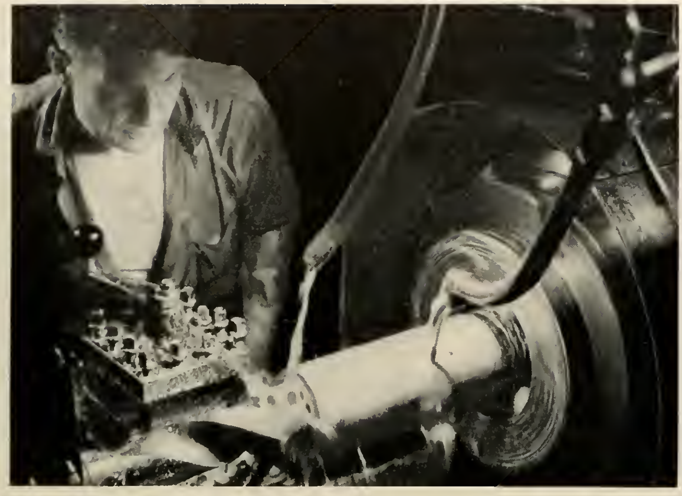

What Makes the Wheels Go Round?

WHEELS that grind flour for our bread, saw lumber for our houses, shape steel for our automobiles; that weave cloth for our coats and dresses, make our paper, print our newspapers. Wheels on which we depend for the everyday necessities and comforts of life. What makes these wheels go round?

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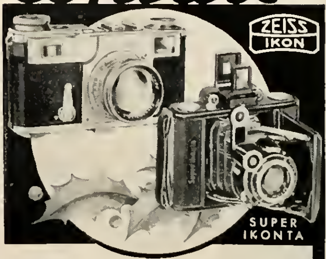

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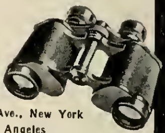

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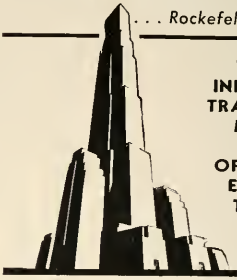

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NATURAL HISTORY

The Magazine of the American Museum of Natural History

Frederick Trubee Davison, President — Roy Chapman Andrews, Sc.D., Director

VOLUME XL—NO. 5 ★ ★ ★ ★ ★ **DECEMBER, 1937**

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From a drawing by Else Bostelmann

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EXPLORATION is the keynote of **ROY CHAPMAN ANDREWS'** distinguished scientific career. A world famous author, he is now the American Museum's Director

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CAMERAS with which he "shot" wild game won for the late **MARTIN JOHNSON** the title of world's foremost moving-picture explorer

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GEMS of all varieties, their history and science, have been colorfully discussed in book and article by **HERBERT P. WHITLOCK**, Curator of Gems and Minerals

Meet Your NATURAL HISTORY Authors

THESE FACES like these names should be familiar to the members of the American Museum of Natural History. They represent a few of the distinguished scientists and writers whose articles in 1937 have contributed to the high level of authorship in NATURAL HISTORY Magazine.

These writers and scores of others too numerous to list speak to you in the pages of our magazine and bring you the best and latest in science, exploration and adventure.

To you, our members, we dedicate the distinguished contributions of our 1937 authors in the pledge to bring you an ever increasing fund of cultural and scientific knowledge.

F. TRUBEE DAVISON,
President, American Museum of Natural History

Don Wallace photo

NATURE is seen as inherently dramatic in the delicate prose of **DONALD CULROSS PEATTIE**, distinguished man of letters and naturalist

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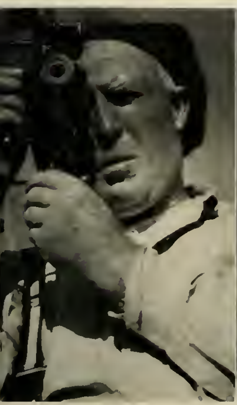
ARCTIC exploration with its manifold thrills and dangers has been the colorful career of **CAPTAIN BOB BARTLETT,** since the days of Peary



THE BIRDS and mammals of Barro Colorado have found a sympathetic and understanding representative in their friend, **FRANK M. CHAPMAN**

MANKIND and his story form the broad foundation on which **HENDRIK WILLEM VAN LOON** has built his many "best selling" books for the average man

MAMMALS from every quarter of the globe have been the goal of many expeditions led or organized by **HAROLD E. ANTHONY,** Museum Mammalogy Curator

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(Right) **EVOLUTION** with its kaleidoscopic picture of life is featured in the highly informative writings of **WILLIAM K. GREGORY,** Curator of Fishes and Comparative Anatomy

Underwood & Underwood

(Extreme Right) **ANIMAL ART** has perhaps its most gifted practitioner in **JAMES CLARK,** sculptor, taxidermist, explorer, and head of the Museum's Department of Preparation

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DOGS, their mentality and emotional relation to man, form the dominant theme of the widely read stories and articles of **ALBERT PAYSON TERHUNE**

STARS, the mystery of the heavens and their interpretation are the major field of that versatile naturalist, Planetarium Curator **CLYDE FISHER**

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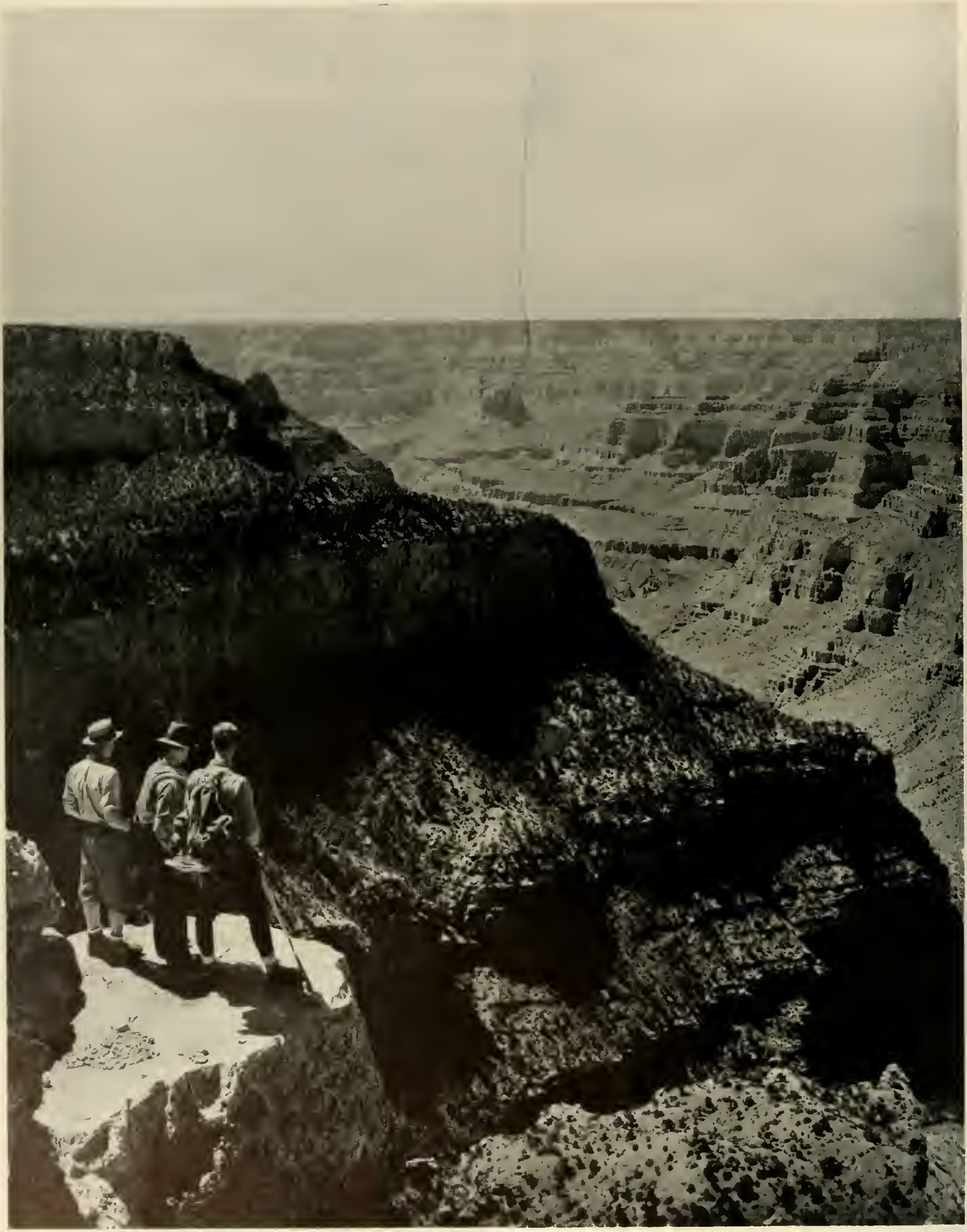


James B. Shackelford

SHIVA TEMPLE, as viewed from the North Rim by the mountaineers: a preliminary survey of possible routes to the summit of the so-called "Sky Island" scientifically explored for the first time by an American Museum expedition. Partial or complete isolation from the surrounding land for many thousands of years was what instigated the study of the animal life on this tableland.

Proposals to descend upon the summit from the air were considered impractical and after careful reconnaissance a route was selected across a narrow ridge or saddle dipping from the Rim to the flanks of Shiva Temple. The expedition had hoped at first to operate directly out of the Grand Canyon Lodge but the distance to the summit proved too great and a base camp was established on the Rim

THE FACTS ABOUT SHIVA—*The real story of one of the most popular scientific adventures in recent years*

By HAROLD E. ANTHONY

Curator of Mammals,
American Museum

SOME months ago when we were planning the expedition to the Grand Canyon of Arizona, to make a biological survey of Shiva Temple and Wotan's Throne, we thought it would meet with considerable popular interest. When we finally established camp on the Temple and the story broke into the press, we discovered that the public had taken the expedition from us, made it their own, and that it was front page news.

Discounting the sensational accounts which had us searching for Dinosaurs and other relics of bygone geological epochs, something that no scientist could ever expect to find outside the covers of a novel, the bulk of the press news covered the facts of the undertaking, and even the daily events, which usually go unrecorded, seemed to be worth paragraphs or columns. Fan mail had begun to reach the Museum as soon as the story of our plans was first published, and when we reached the Canyon we already had an audience pulling for us. After our beacon fire on Shiva advertised the fact that we were on the top, this audience grew to incredible proportions. Now I get mail addressed to me "Shiva Temple, Grand Canyon, Arizona." Shiva Temple is on the map, it has been featured in political cartoons, or as a catch-phrase in a radio program. What is there about Shiva to thus capture the popular fancy!

Shiva Temple is situated in the Grand Canyon of the Colorado River. It rises from the river-bed itself along its southern face and is connected to the North Rim of the Canyon by a narrow ridge about a mile and a half long which drops down to a saddle some 1300 feet below the top of the Temple. Shiva Temple is in plain sight from the rim of El Tovar, where most of the visitors view the Canyon, and is one of the dominant features of the far canyon, about nine miles distant. The top appears to be flat, covered with vegetation, and seemingly separated by deep, impassable gorges from all neighboring areas of equal elevation, and in most respects this is not a false impression.

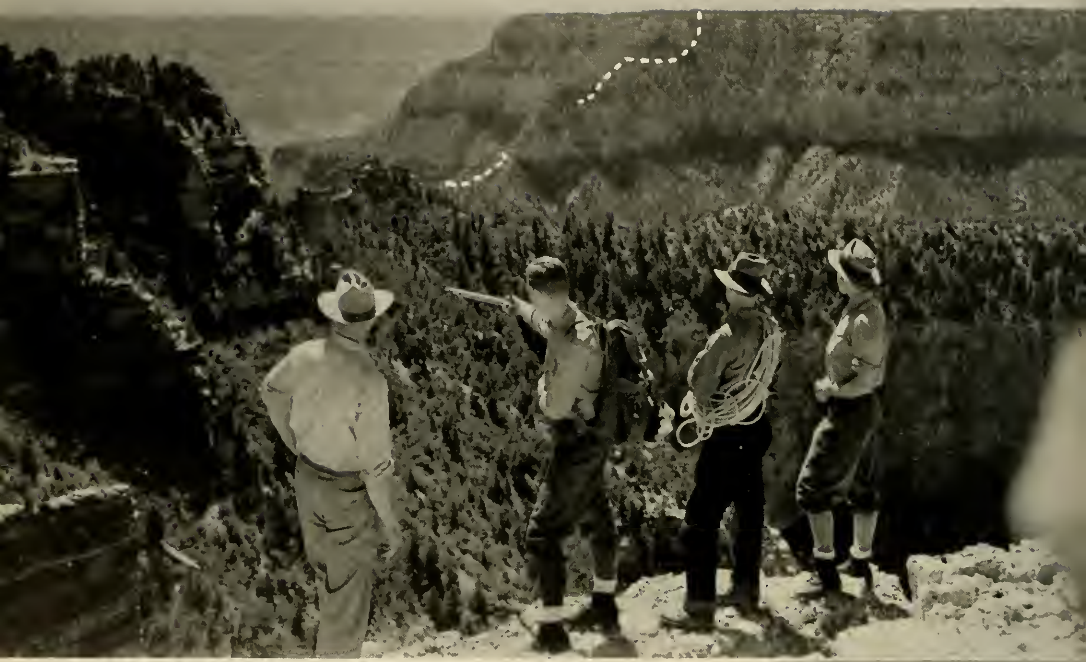
It is easy to understand, then, how anyone sizing up Shiva from the South Rim could visualize the area as a little world set apart, an unexplored region with unknown possibilities. We had every reason to believe that no one had made a collection of the animals that might live on the Temple. We had no knowledge that a white man had even climbed it. Everything known about the place tended to intrigue the curiosity, and yet the plateau itself was being viewed daily by hundreds and thousands.

Soon after the first press notice of the trip was published, we began to receive suggestions as to how Shiva could be conquered. They ran the gamut, from the sublime to the ridiculous. Some of the ideas which involved elaborate construction of cable-winding devices on the North Rim, with a specially equipped plane to drop grapples on the Temple, certainly called for a sublime disregard of expense and the safety of the aviator. To attempt some of these would entail the construction of an airport on the adjacent rim.

One man whose proposal was brought up to me

HAROLD E. ANTHONY has engaged in twenty Museum expeditions, in North, Central, and South America, the West Indies and Africa. In a space of little more than a year (1928-1929) his studies in the field took him from the Arctic Ocean to the Straits of Magellan. His first expedition for the American Museum of Natural History, in the spring of 1911, was to Lower California on the Albatross Expedition, shortly after which he became a permanent employee of the Museum. Since 1926 he has been Curator of the Department of Mammals of the World.

He has specialized in the mammals of South America and the West Indies, and has been actively interested in the mammals of North America for which he has written several popular text books. He has also served as an active member of many conservation organizations as an advocate of the preservation of natural conditions and more specifically the protection of mammal life.—THE EDITOR.



THE TRAIL from the base camp on the North Rim dropped down through the Kaibab Limestone and Coconino Sandstone to the temporary camp at the lowest point on the ridge which tongues out to Shiva. This spot is hidden in the photograph by the ridge in the foreground and was located just to the right of the pointer at the foot of the slope rising toward Shiva's summit

ON THE SADDLE between the Rim and Shiva: before starting the climb to Shiva the party glanced back over the descent from the North Rim comparing its problems with those that lay ahead. Knowing that the climb from the saddle to Shiva was the more precipitous they made an early start, allowing a full day

SHIVA TEMPLE, from the North Rim, presents bold cliffs for most of its northern face. The deep series seen at the base did not need to be scaled, luckily, for the connecting ridge brought the climbers around to the left at the foot of the second series. The summit appears flat in profile but in reality it is crossed by several gorges which open to the south

All photos by James B. Shackelford

SHIVA TEMPLE, dominating the sky line, and Wotan's Throne, just visible to the left, are both seen from Point Sublime. Shiva Temple has an area of about 275 acres, Wotan's Throne 135 acres. The broader band of cliffs on Shiva forms the Coconino Sandstone and the upper cliffs are in the Kaibab Limestone when I was camped on the top of Shiva offered to assume personally any hazards inherent in his idea. He had read in the paper that planes were flying over Shiva low enough to see the foliage on the trees (which was true enough). He volunteered to put on a football helmet and padded garments and, with a coil of rope in his arms, throw himself from a plane into the tops of the trees. Once on the top. it would be easy to go to the rim and let the rope down over the cliffs to the party waiting below. If one length of the rope was not enough, he could take two. That man thought of everything! If he could have seen what happened to the second parachute cargo that was dropped from a plane crossing at 140 miles an hour, when the knot in the rope ran out and the hundred-pound can of water hit these same trees, he might have discovered one little item he had overlooked, namely, a shovel to gather himself up with afterward. But this is running ahead of the story.

Aerial approach considered

The first plan to reach the top of Shiva contemplated aerial transportation. But aerial photographs disclosed that the forest was too dense to permit an aeroplane, even an autogiro, to land safely, and the reports of strong and variable air currents indicated that a dirigible might be unmanageable over the Grand Canyon. However, these pictures showed the terrain in such detail that it was possible to plot several potential routes for climbing these canyon islands from the bases of the short ridges connecting them to the North Rim.

When our expedition took on the aspect of a cliff-scaling project, it seemed advisable to have expert advice. From the American Geographical Society we received cooperation not only in reading the aerial photographs and mapping probable trails, but even in the actual attempts upon the rock walls themselves.[1]

The plans had begun with only a small party intended for the undertaking but, like a snowball, had grown in size as the possibilities unrolled. Our tryst at the South Rim assembled no less than nine individuals who were to take an active part.[2] We made the necessary arrangements for provisions, which had to be flown in from the South Rim, and then all drove over in automobiles to the North Rim.

Base camp

It is possible to drive a light truck through the pine forest of the North Rim to the very edge of the canyon opposite Shiva. Here a tent was set up and several large, covered, galvanized cans, holding about thirty gallons or more of water apiece, went out with the first trucks. Camping equipment for the top—beds, canned goods, traps, ammunition, collecting chest, et cetera—was transported in the Park Service trucks to this base camp, a fairly simple matter. In one day this camp was established and we also moved light outfits down to a temporary camp on the saddle where we spent the night. The descent from the rim is not difficult for an active person, but it can be work for anyone carrying a pack.

Our camp on the connecting ridge, referred to as the saddle, was a very temporary affair. A small tent was set up and our beds were spread out under the low trees wherever level spots could be found. We reached the place late in the afternoon and had just about time for such casual preparation before darkness descended.

An item of some concern to the climbers, when we were discussing plans in New York, was whether rattlesnakes were common in the Grand Canyon. A man climbing a cliff, with hands and feet fully occupied in maintaining a precarious balance, would be aroused to no great burst of enthusiasm if he pushed his face over a ledge to find a snake looking him in the eye. Rattlesnakes were reported to be rare on the canyon rims, exceedingly so on the North Rim, but to be on the safe side I had a snake-bite outfit in our equipment.

Nothing eventful happened during the night but we missed a rattlesnake by only two days. The packers found it, a big red one, actually in the tent, on one of their round trips to Shiva. Had it crawled into one of our sleeping bags this first night, something a snake is known to do, we would certainly have had some excitement for a while.

---

[1] Mr. Walter A. Wood, Jr., of the American Geographical Society, a veteran mountain climber on three continents, accompanied our party to be in charge of the climbing, which we knew would be arduous and very likely dangerous. To assist him he had Mrs. Wood, who had been his lieutenant on former mountain-climbing expeditions, and Mr. Elliot Humphrey.

[2] I planned to do the collecting of specimens with George B. Andrews, the son of Director Roy C. Andrews, as my assistant. He might also be included with the three mountaineers, if they needed an additional experienced climber, for he had training in the Swiss Alps. Miss Amy Andrews had volunteered her services as pilot and the use of her Stinson aeroplane for aerial reconnaissance and the landing of parachutes on Shiva. Mr. Morehead Patterson, interested in the project from its inception, was there with his pilot and Beechcraft plane for aerial photography and survey. Mr. James B. Shackelford was the expedition photographer.

By this time I had discovered that the publicity would swamp the serious work of the expedition unless I ignored it as far as was reasonably possible. With reporters on both Rims, a special-feature writer dogging our steps, a portable short-wave radio set in our equipment (loaned by the Park Service), we had about as much privacy as the proverbial goldfish. Later, when on top of Shiva, I was to discover that the most trivial happening was going out over the radio on the rim. If I tried to be funny in a note to someone on the rim, there was no telling where the joke would stop; if I blew my nose it was likely to be heard around the world!

The climb

We were all up at daybreak on the 16th and soon reached the cliffs of the Coconino sandstone, only a few hundred yards from where we had slept. Here seven of us roped together for the climb, one group of four to a rope, the other one of three. The first party climbed in this order, Wood, Anthony, Mrs. Wood, and Tillotson (Park Superintendent); the second, Andrews, Humphrey and McKee (Park Naturalist). We were roped at intervals of about twenty feet and the procedure was simple. Wood found a place he could climb and ascended until he took up the slack rope between us. Then he stationed himself so he could keep a firm strain on the rope as I came up. When I reached his ledge I did the same for the person next in line, and so the group progressed. The responsibility was upon the first in line for he had no one holding tightly to his rope in case hand or foot slipped or a rock gave way. The loose rock was a very definite hazard, however, to those following, who had to be constantly on the alert. The only mishap we had during the climb came from just this source. Humphrey was struck by a rock dislodged by the rope of the man above him. It was not a large rock or Humphrey would have been killed for it struck him on the head, cut through his hat and laid his scalp open.

I was relieved to find that the Coconino formation, at the point where we climbed, ascended in a series of pitches with narrow ledges, cracks and chimneys, so that there were plenty of places to step and grasp, and the climber was continually working back from a sheer cliff face. The vertical pitches did not exceed 20 or 25 feet and while the Coconino is about 350 feet thick, the ledges carried one successively back so that one did not have the dizzy sensation of seeing several hundred feet straight down between his feet. From the top of the Coconino there remained only the Kaibab limestone to climb, and because most of this was broken down into steep slopes of loose rock and thin soil, we traversed this as individuals, each man for himself.

Six of us stood on the top of Shiva shortly after noon that day. After a reconnaissance about the top of Shiva, only McKee and I remained when the others descended to assist the packers and to climb down to spend the night in camp on the saddle.

We had engaged as packers six young men from Kanab, a Mormon community just over the Utah line. They were accustomed to climbing about broken country, were interested in our undertaking, and were very useful in maintaining daily contact with the North Rim. On the first two days, however, everything was new and the organization had not been shaken down to reach the degree of efficiency that it later attained.

To make a long story short, the packers were late in reaching the foot of the Coconino, and a canvas bag of provisions burst and scattered packages of canned goods down the cliffs, with a consequent loss of time in picking up the pieces. The end of the afternoon found us with a small depot of supplies midway between the saddle and the top of Shiva and enough on the top itself to spend the night in comparative comfort. George Andrews came up with the last load to make three of us about the evening fire.

We could see the lights of El Tovar shining on the South Rim, some nine miles distant; and we made a huge blaze of dry limbs on the south edge of Shiva which we felt sure would notify our friends that the expedition was finally on Shiva.

Supplies by parachute

The worry of supplying the camp on Shiva was very greatly reduced when Miss Andrews' plane came into action. Her aeroplane was scheduled to fly over for the first parachute drop at 6:00 p. m. on Sept. 17th, the day after we reached the top. McKee had returned to the North Rim that morning and George Andrews and I had Shiva to ourselves. We had scouted out a place fairly free of trees for our "Shiva Airport," tied up a couple of markers we hoped would be visible to the plane, and piled up brush for a signal fire, the smoke from which would indicate the strength and direction of the ground wind. The "airport" was about a quarter mile from our camp.

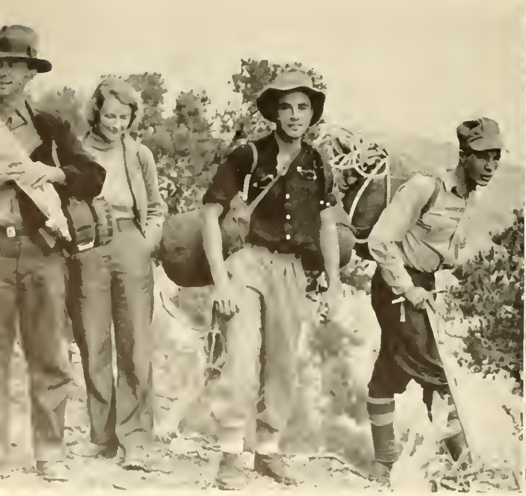
A few minutes before six o'clock we heard the distant roar of the plane's motor out over the can-

From the camp in the saddle: the trail ran fairly level a short distance across the dark red shale of the Hermit Formation and then brought the climbers to the great rocks piled at the foot of the Coconino Sandstone. At this point one had to pick his way carefully, though there was no danger of falling great distances

All photos by James B. Shackelford

(Right) At the base of the sandstone where debris from the cliffs had built up a talus slope rendering the climb less arduous than farther on. When all the fallen material had been passed the most difficult part of the ascent was reached and the climbers had to cross faces like that at their left

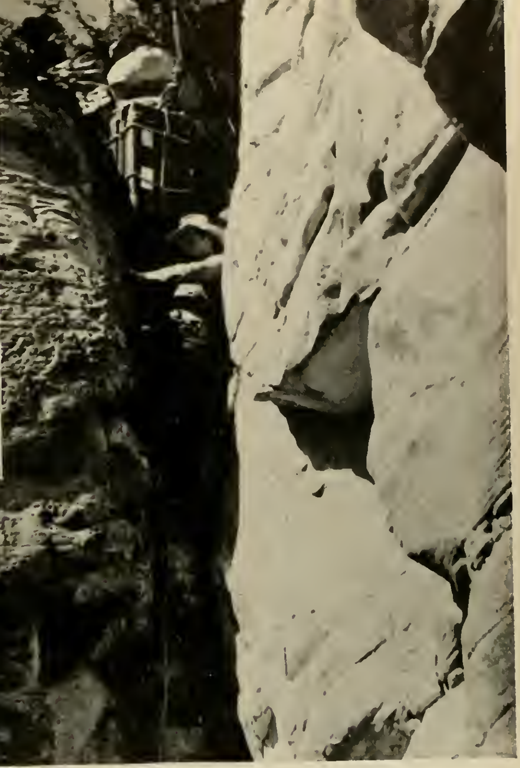
The well dressed mountaineer will carry a coil of rope, canteens filled with water, some food and perhaps an alpenstock, and his bed if he contemplates passing the night



Evidence of a previous unsuccessful attempt to scale Shiva: equipment found near the foot by the expedition, which according to a newspaper account was abandoned by two young men from Los Angeles who failed to reach the top

Photo by James B. Shackelford

When Humphrey was struck on the head by a falling rock, the expedition might easily have met tragedy. Had he been stunned outright and fallen from the cliff he might have carried the others roped to him



A cleft or chimney in the cliff was much easier to climb than the formation at either side, especially if a tree grew handy for holding the rope

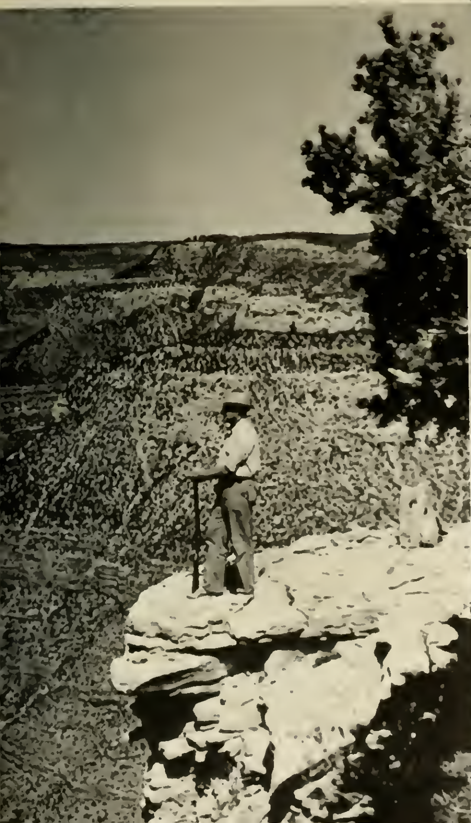
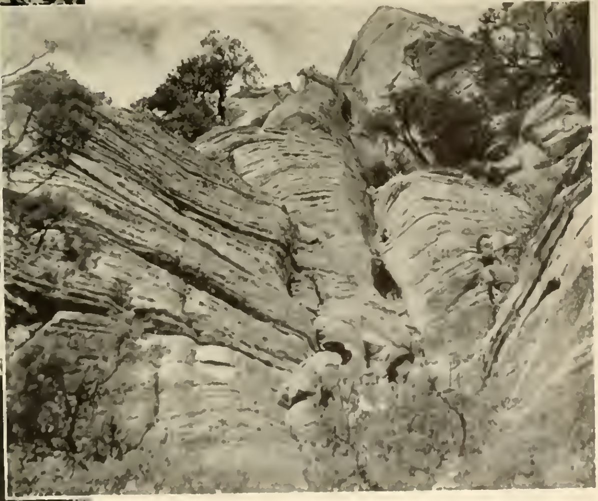


Photo by H. E. Anthony

Some of the out-jutting points of Shiva Temple seemed hanging in the air, hundreds of feet above the floor of the Canyon. At such a spot one had the sensation of standing literally on top of the world

Rocks which if they had been smooth would have been impassable: a slope which confronted the climbers at the foot of the Coconino and contrary to appearance in the photograph rose nearly vertically



(Left) Aerial motion pictures in color were taken of the dropping of parachutes with food and water to the campers on Shiva. The door was taken off the plane hired from the Grand Canyon Airlines and the photographer lay on the floor

All photos by Shackelford

(Above) Changing cloud effects kept the photographer busy at times recording the beauty of Shiva's canyon setting

(Right) Miss Andrews' bright red monoplane was a welcome sight to the party on Shiva for it heralded the arrival of parachutes with food or water. From left to right, William Gulick, Miss Amy Andrews, Morehead Patterson, Mrs. Wood and Walter Wood prepare to fly from the Grand Canyon airport on the South Rim

WATER was the most vital need on Shiva for there was not a drop on the plateau. Cans in parachutes were lashed under the plane to be carried to Shiva

Photos by James B. Shackelford

THE PORTABLE RADIO used by Superintendent Tillotson on the North Rim to keep in touch with the outside world. The set was taken only as far as the saddle because the demands of the press would have interfered with the work on Shiva

A METAL DAIRY CAN holding 10 gallons of water which was landed on Shiva by parachute without losing a drop. This amount of water transported from the Rim would have necessitated great labor, whereas the plane deposited it from the airport in about 15 minutes

Photo by H. E. Anthony

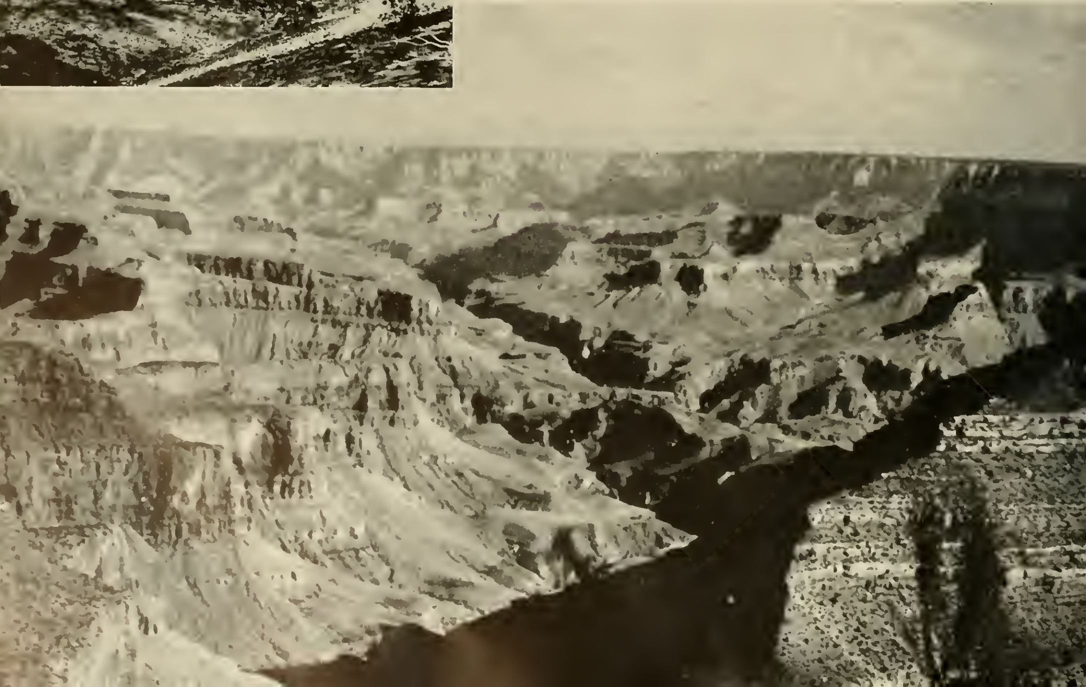
(Above) A SMALL, LIGHT TENT was set up on Shiva for shelter in the event of rain. During most of the period the weather was dry but when thunderstorms drenched the plateau protection for equipment, specimens and personnel was imperative

(Left) DEEP GORGES, towering cliffs and barren slopes make every view from Shiva's edge impressive. The ravines are ordinarily bone dry, but in heavy rains such as occurred when the expedition was on the Temple the sound of running water was audible

(Left) THE FOREST on Shiva is open with but little brush or other vegetation under the trees. The yellow pine is the largest species found there and it reaches a maximum diameter of about three feet. We noted trees scarred by lightning and evidence of forest fires which had not done much damage

FROM THE TEMPLE one can see many miles up and down the Canyon. The air is remarkably clear, and distant objects appear deceptively close. The limits of vision are fixed not by the blue haze of distance but rather by the topography and irregular course of the Canyon which winds out of sight behind an intervening shoulder

All photos by H. E. Anthony



(Above) Shiva Temple seems to be drier and warmer than the North Rim, and several species of cactus grow abundantly

(Center above) The mescal of Shiva is a variety of century plant with stiff, thorn-tipped foliage. The young plants grow in a compact clump

(Above right) When mature the mescal, or "yant," sends up a tall flower stalk twelve feet or more. The Pueblo Indians used the starchy center of this stalk for food, baking it in earthen pots

Photos by H. E. Anthony

(Right) We found the rock piles of several "yant ovens" on Shiva. In the shallow pits the Indians piled heated stones, set in the pot of mescal or "yant" and then domed over everything with more hot stone. Fragments of broken pots, some decorated with simple designs, plain or in color, were scattered about these sites

(Below) From Cape Royal, on the North Rim, it is possible to get a glimpse of the Colorado River at the bottom of the Canyon. From most portions of the Rim the river itself is hidden and there is little to show that a stream of this size is present

Photo by James B. Shackelford

THE DESCENT. A collecting chest which was one of the necessary items on top of Shiva, entailed difficulties of transportation up and down the Coconino Sandstone. A pole was lashed to the chest and two men worked it along the narrow ledges. The photograph shows one of the easier sections of this Formation. The specimens were all securely pinned to boards in order to withstand the shaking and jolts *H. E. Anthony photo*

DR. HAROLD E. ANTHONY, upon opening the collecting chest at the Grand Canyon Lodge, discovers that the mammals have come through in good shape, with their ranks unbroken. *James B. Shackelford photo* yon and ran from the camp to the "airport." We reached there just as the bright red Stinson flashed into sight. The plane was high and we had no way of telling whether our fire was seen. Fortunately one of us had a clear view through the trees when the parachute was dropped. The 'chute opened promptly and settled down on the top of Shiva, out of sight and possibly an eighth of a mile away; the white silk was caught on a small juniper and made a conspicuous landmark.

When we worked the 'chute down from the tree we had to be careful lest the silk be torn. I bent down a limb to free a fold and a headless mouse dropped into my hand. The body was somewhat dried up and I presume it was left there by an owl, otherwise I would have been forced to conclude that another native of the Grand Canyon had lost his head over the excitement of the expedition. At any rate, it seemed a good omen of what our traps might catch, unless indeed the bird of prey had flown its catch over from the Rim just to puzzle us.

As a joke on our party, I heard that some of the local wits had considered flying over Shiva in a plane and dropping some trinket of the modern age, such as a Ford radiator or an old tire, so that we could be properly surprised when we reached the top.

Eggs dropped

The first 'chute carried a load of provisions safely to our hands. It was a big carton snugly packed with a lot of staple supplies and a few unexpected luxuries. A dozen eggs packed in the type of carton commonly found in grocery stores came through without a crack. There was a note with the supplies stating that the plane would return to drop water as soon as it could make the trip to the airport and back. Sure enough, the red plane soon roared up out of the south, flashed over Shiva and dropped a 'chute some distance from where we were watching. I saw the 'chute start to open and then drift like a crippled, shapeless thing, as the rope holding it to its cargo slipped a knot. The package rushed toward the plateau at high speed and disappeared back of the trees. It looked, from where I stood, as if both 'chute and cargo had missed the "island" and it was certain that the cargo would be ruined even if it struck the top.

Dusk was drawing on and we had time for only a hurried search for the second 'chute and its load. We found neither and then carried our provisions back to camp. Luckily we had a little water in a canteen and expected the packers to carry some up next day. Also we had canned tomatoes which supplied some moisture for the next meal or two.

The next day saw us well established with a small tent set up, food enough for some days, and water coming up in canteens carried by the packers who could now make the trip from the Rim and back easily in a day. And with traps and equipment to collect specimens, we could forget the outside world and explore the possibilities of Shiva.

That morning two of the packers helped us look for the lost load and one of them located it. It was a heavy metal dairy can of ten-gallon capacity, but it was split wide open by its impact with the ground. Although we searched closely for the parachute, worth a good round sum, that day and several of the following, it was a week before we located it.

On Sept. 19th we were literally bombarded with parachutes. We knew that more would be dropped because we had five 'chutes originally. This day was Sunday and we heard a plane coming about half past seven o'clock in the morning. Planes were frequently flying over Shiva and distracting us considerably because we had to be on the watch lest a load be dropped when no one was at the "airport" to see it land. Commercial planes passed over several times a day, and every time we heard the roar of an engine we had to drop whatever we were doing and leg it for the "airport." At over 7000 feet elevation, this took wind. Although Wood and I had agreed on a stated time for morning and evening visits by the Stinson, I could not be certain that we would not get calls off the schedule.

When we reached our "airport" this particular morning, Miss Andrews and Wood had already passed over the plateau. We easily recognized the plane but saw no 'chute dropped and could not be certain that one had been dropped. Soon the red plane was back again, in company with two other planes, and this time a 'chute was seen falling and the location marked down. While George was going to it he discovered a load that had been dropped on the first call. Before these were cleared away the plane rushed by on a third trip and the 'chute that was dropped came to rest only a few feet from the second.

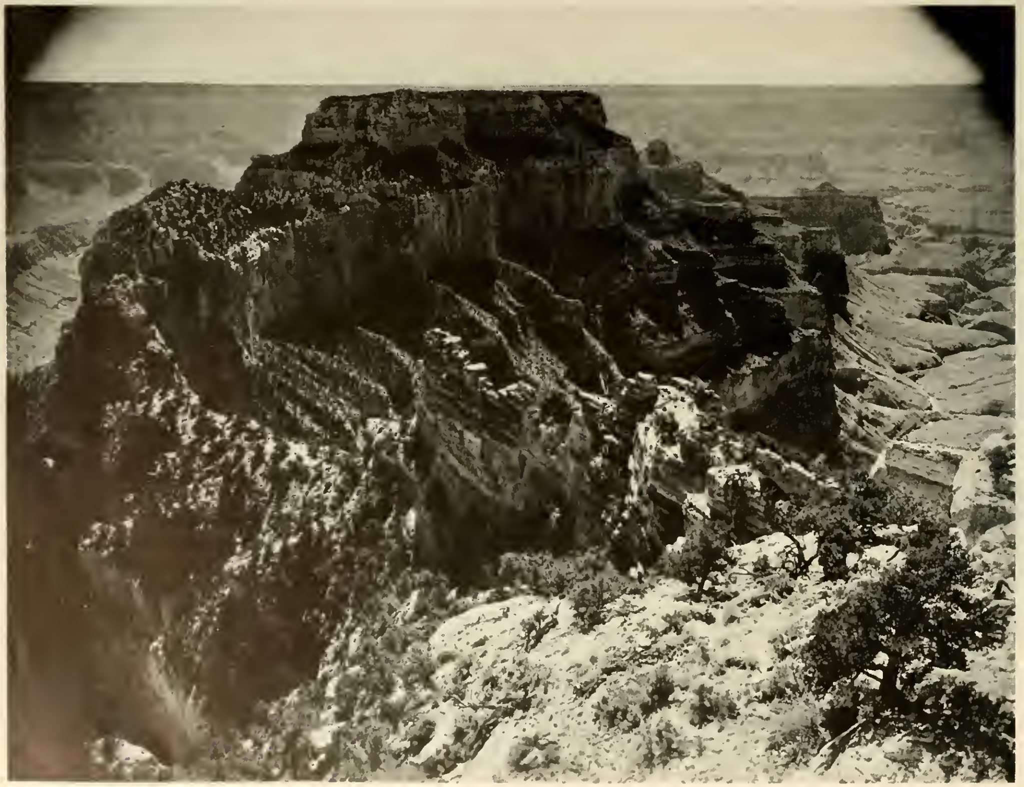
Specimens abundant

Small mammals are plentiful on the top of Shiva for there is abundant food for them there. The traps we set out, baited with a mixture of rolled oats, raisins, cut-up bacon and peanut butter, caught something about fifty per cent of the time. Often an expedition has to put out 150 to 200 traps to insure a fair catch, but on this isolated mesa 50 or 60 traps were sufficient to keep me skinning most of the day. The traps were moved frequently to try out each type of environment; among the rocks

Continued on page 775

PARTY that ascended Wotan's Throne, which looms in the background: (left to right) Elliot Humphrey, Walter Wood, Mrs. Wood, Preston Swapp, George Andrews

(Below) THE NARROW RIDGE joining Wotan's Throne with the Rim is cleft by chasms which made it impractical as a route in the successful ascent *(Shackelford photos)*



SCALING WOTAN'S THRONE—*An exciting feat in which Shiva's sister "sky island" yields to the skillful rock climbers of the Patterson Grand Canyon Expedition*

By GEORGE B. ANDREWS

"WATCH out below!"

The cry was accompanied by a crash that echoed between the walls of the narrow gully, as a rock the size of a man's head rolled off the ledge and disappeared into the void. We listened; it seemed eternities later that a faint booming noise drifted up from the floor of the chasm.

Walter looked at us. "We've got to watch this loose stuff—it's poison."

He picked up his pack and peered over the rim. "I'm going to rope down here," he said, "and find out what it's like below; if that next ledge is wide enough, send down the packs."

He passed the longest rope around the base of a sturdy pine and let the ends hang over. I peered down and saw that the rope barely reached.

"See you all below," he said grinning, "and be careful about rocks."

Passing the rope under his thigh and around his shoulder, he very deliberately leaned far out over the edge of the cliff, and with his legs firmly braced against the rock he disappeared below.

We couldn't see what was happening down there—only the taut, bar-like rope hanging over the edge, and the scraping of boot nails on rock gave evidence to his movements. I looked out beyond the walls of the gully into the sun-baked canyon. Deceptively close were the sheer crags of the towering, flat-topped mesa.

It was Wotan's Throne in the Grand Canyon. Shiva Temple we had conquered a week ago. About a square mile in extent, each of them had stood in solitary grandeur for half a hundred thousand years, and from the rim of the canyon millions of eyes had watched the sunset shadows drape them in a mantle of purple and gold. Shiva Temple was not as difficult a climb as we had anticipated. We had reached the top and I had remained with Dr. Harold E. Anthony, leader of the expedition, for a week. We had found an abundance of life and made a fine collection.* Wotan's Throne still remained unconquered. Doctor Anthony sent me off with the other climbers, Walter Wood of the American Geographical Society and Jack Humphries. We were to scale Wotan's Throne if it could be done to establish a route for the naturalists to follow at a later date.

Like Shiva Temple, Wotan's Throne had been cut off from the main rim of the canyon some time between 35,000 and 100,000 years ago. Its summit was nearly a square mile in extent. Both mesas were natural scientific laboratories where the animals and lizards and non-flying insects might exist in their primitive state.

From the aeroplane photographs scaling the sides of the mesa did not seem to be as difficult as getting down off the north rim of the canyon. There were sheer drops and overhanging ledges and always loose rock. That was what had made the Shiva climb difficult. Humphries' experience on Shiva's cliffs of being struck on the head by a falling stone which might easily have killed him was fresh in our minds, but rock climbers do not let their imaginations dwell on accidents—at least the thought of them doesn't deter one who really loves the job. No rock climber can tell you what it is that makes him risk his life to stand on a pinnacle that has never been scaled. It is one of those subtle things that can only be felt—not told.

I had climbed in Wales and Switzerland. Wood was a veteran of the greatest mountains in Alaska and the Himalayas. But never did we have a more

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*See "The Facts about Shiva," by Harold E. Anthony, page 709, this issue of NATURAL HISTORY.

GEORGE B. ANDREWS, who assisted Dr. Harold E. Anthony on top of Shiva's Temple and was a valuable adjunct to the expedition because of his previous mountain climbing experience, is a son of Dr. Roy Chapman Andrews, Director of the American Museum, and nephew of George Borup who was a member of Peary's final polar expedition.—THE EDITOR.

dangerous climb than getting down to the base of Wotan's Throne.

"And," I thought to myself as I stood on the overhanging rim, "we're having a hard enough time as it is, with our small packs. Carrying food and water and scientific equipment for a whole expedition down this gully would be impossible."

My thoughts were cut short by Walt's voice from below. "Hey, how about some signs of life up there, George. Send down the packs as soon as you can, and two of you come down and join me—the ledge will hold three at a pinch."

With time-consuming slowness we inched our way down the treacherous, overhanging ledges. The steepness of the rock and the ever-present danger of falling stones forced us to be extremely deliberate and careful in all our actions. Walter, scouting the way ahead of us, was constantly subjected to the danger of bombardment from above, as the swinging packs and canteens were lowered to him. Once or twice small rocks, unavoidably dislodged, whizzed past his head with an unpleasant drone.

A narrow escape

The long evening shadows were beginning to filter into the gully and we were still several hundred feet from the bottom. Possibly I was growing tired—or perhaps it was the feeling of being pressed for time that made me careless; whatever it was, I almost wrecked the chances of the whole party and nearly killed myself.

Walter Wood had disappeared below an overhang and I was lowering a heavy food pack to him. What exactly happened I can't remember—possibly I turned to say something to one of the others—when suddenly I felt myself being hurled off balance by the weight of the pack. Grabbing wildly for our connecting rope I managed to get one hand on it as I rolled and slithered to the brink of the overhang. I jerked to a stop in a cactus bush and all I could think of was for the safety of my pipe. I eventually discovered it in my mouth.

Walter, down below the overhang, couldn't see what was going on. Hearing the commotion above, he called up innocently, "Are you coming, George?"

"Walt," I said when I could get my breath, "you'll never know just how close I was to coming—head first."

I'm afraid the others were slightly suspicious of me after that episode; however, it was the only close call from falling that any of us had.

Twilight found us at the foot of the gully on a steep rocky slope. As it was too dark to move on and find a more horizontal camping spot, we settled down for the night where we were; and the awe-inspiring grandeur of our surroundings made up for the lack of comfort. On three sides sheer rock walls towered up to the night sky, rising vertically for hundreds of feet. The reaching firelight flickered and died and cast strange colorless shadows on the surrounding cliffs.

We crouched around the fire, saying little and eating sparingly. It wasn't food we wanted, but water. Jack Humphries passed one of the canteens around, holding it lovingly—"Three swallows apiece," he cautioned us, "and suck on this lemon; it'll do more good than a pint of water."

Walter sat on a rock off in the shadows. As the fire leaped up for a moment he looked about him appraisingly—Jack, sitting quietly with a dreamy look on his face as he allowed a trickle of water to run down his throat—Mrs. Wood, with her back to a rock, staring up at the three stars winking down at us—good old Preston, the Mormon packer, carefully stowing away a canteen under a boulder. He looked at me as I squirmed uncomfortably trying to favor the bruises on my anatomy resulting from my spill.

"Walt," I asked, "what are our chances of making the top tomorrow morning, if we start at dawn?"

"Can't say. If the rock is as difficult tomorrow on Wotan as it was today coming down from the rim—" he left the sentence unfinished. "Of course, we'll be traveling light, but we'll have to make better time than we did today."

Jack suddenly spoke up, "Look over there to the east," he pointed to a faint glow that haloed the twisted mesas in the canyon, "the moon's rising."

Far into the night I lay awake watching the unearthly beauty of the moon-flooded gorge. Each individual rock spire and mesa stood out in startling relief against the background of drifting shadows, transformed into objects of beauty and mystery under the passionless white light.

The last stretch

A few hours later, gray dawn found us clustered about the fire, ready to leave. A quick breakfast, a swallow or two of water, and we were on our way. No packs this time—just the rope, cameras and a canteen.

By sunrise we were making good progress along the steep rock slopes that led to the cliffs of Wotan. Roping together as the going got more difficult,

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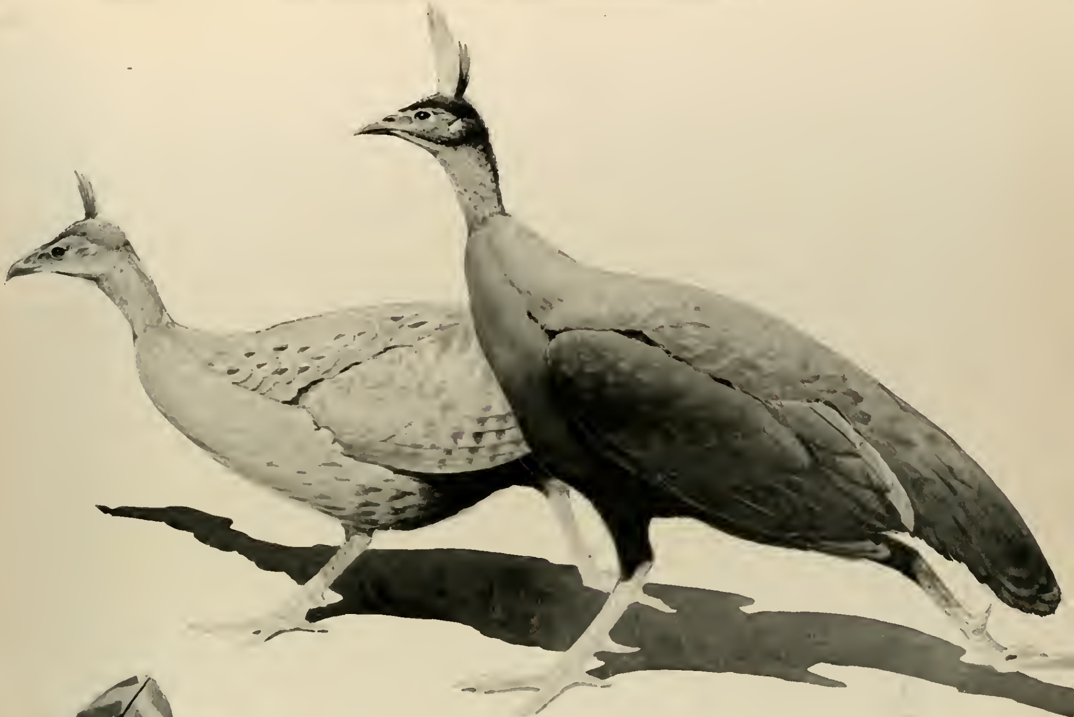

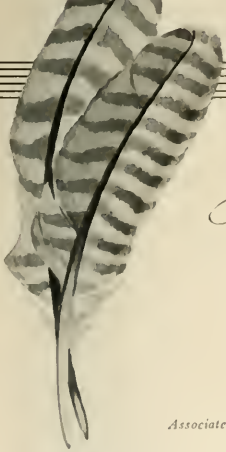

In pursuit of the Congo Peacock

A MYSTERIOUS FEATHER PLUCKED 24 YEARS AGO FROM THE HAT OF A CONGO NATIVE BECOMES A CRUCIAL LINK IN A 7000-MILE QUEST

By JAMES P. CHAPIN
Associate Curator, Continental Old World Birds, American Museum

WHEN I sailed for Belgium in July, 1936, to continue my work in the Congo Museum on a second volume of the birds of the Belgian Congo, I little expected that I was to participate in the tracking down of a large pheasant of the Congo forest still unknown to science. You might say that a bird of this type was the last thing I was looking for, because it was altogether unlikely that an important genus of the Phasianidae could have been overlooked three years before in the publication of the first volume of this work.

Soon after I had been comfortably installed in the Congo Museum a few miles outside of Brussels, I had occasion to confer with its director, Dr. Henri Schouteden, one of my best friends from the days when I began studying the collections there at Tervueren fifteen years before.

My route through the Museum in quest of him took me by pure chance past a hall that formerly housed the Congo birds and through a corridor that I had never before entered. It was here that my

JAMES P. CHAPIN's scientific memory for details, coupled with his keen artistic eye, constitutes one of the many qualities which have made him a distinguished bird man. With an intense interest from boyhood, he came to the American Museum in his teens and when no regular position was open he devoted a year exclusively to stuffing birds. In 1909 he became a regular member of the staff and in the same year went out to study the birds of eye fell on the two mounted pheasants, standing on top of a cabinet.

Had I seen these specimens in any other museum, I might have paid little attention. But the Congo Museum contains practically no birds except those from Africa, and never had I seen any like these. They were somewhat larger than domestic fowls; one appeared blackish, the other more rufous. Yet the black-barred wing-feathers of the rufous bird awoke a memory. We lifted them down, and found still attached to one of the stands an old cardboard label, reading *"Pavo cristatus,* jeune, importé."

This was plainly an error, as the birds were much smaller than peacocks, the blackish example had very large spurs so it could not be young, and the wing-quills of the rufous bird told me it was truly a Congo bird. Some of its secondaries seemed exactly like a mysterious feather which I had preserved since 1913, when I took it from a native hat at Avakubi in the Ituri Forest.

A clue

Several unknown feathers were tied in a small bundle, labeled, and brought home in 1915 with my first Congo bird collection. A few took some little time to name, but eventually there remained only a single quill which puzzled me. It was rufous regularly barred with blackish, resembling in color the secondaries of some of the coucals, birds of the cuckoo family, but was far too large. The stoutness and curvature of its shaft, as well as the form and texture of its web, strongly suggested a gallinaceous bird. But it was larger than the corresponding quill of any guinea-fowl or francolin, had a different color-pattern, and could not have come from any wild gallinaceous bird then known to inhabit Africa. I showed it to a number of my friends, I compared it with domestic hybrids between chickens and guinea-fowl, all to no avail. For a while I felt that it might come from some species as yet undiscovered, but this seemed preposterous, so I laid it away in a place where I could refer to it at any time. Now I had stumbled on the bird from which it must have come.

How had these specimens reached the Congo Museum, and where had they been collected? The first question was readily answered by Doctor Schouteden. In 1914 the Kasai Company, which once enjoyed a monopoly of trade in a large section of the southern Congo Free State, turned over to the Congo Museum a collection of about sixty mounted birds which had been on display for some years in its offices in Brussels. Among the sixty were a few domestic fowls and these two alleged peacocks, already labeled as explained above. Inasmuch as the "peacocks" were said to have been imported, they seemed to be useless for exhibition purposes in the Museum, and so were laid aside in the place where I found them.

In 1914 Doctor Schouteden had only just begun the study of African birds, though he was already an expert on many other groups of African animals, and he had no ornithologist on his staff. His splendid "museum conscience" forbade the destruction of any specimen that had not been thoroughly investigated, and so the birds were secure until someone should come along to study them. It was my good fortune to be the man, and it was Doctor Schouteden's generosity that prompted him to urge me to go ahead and look into their relationship.

The possibility of their being domestic hybrids of some sort could not be entirely neglected. Crossing between peacocks and some other gallinaceous birds has been done, but none of the results resembled the specimens now before me. Then there was my feather, found in the Ituri Forest long before any Asiatic peacocks could possibly have been brought there.

Locality

The question as to the origin of the specimens still remained. It seemed more than likely that these birds must inhabit the equatorial forest. The Kasai District is largely grassy, with only patches of heavy forest; and since the mounted specimens probably came from the region of the Congo, I concluded that they might have been secured in the Sankuru District near the upper Lukenie River.

However that might be, I was soon to learn of one locality in the eastern Congo where the species was certainly to be found. On August 12th, I was invited for luncheon in Brussels by Mr. de Mathelin de Papigny, whom I had met in the northeastern Congo in 1911, when he was an engineer in the Kilo gold mines. Since then he had discovered im-

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the Belgian Congo, an investigation which he has continued with interruptions ever since. Almost thirty years of experience in African birds, therefore, lie back of the scientific "detective story" told here.

In 1931 the late King Albert of Belgium honored him with the *Ordre de la Couronne* in recognition of his researches in the Zoölogy of the Belgian Congo. He was also awarded the Daniel Giraud Elliott Medal by the National Academy of Sciences in honor of his work entitled, "Birds of the Belgian Congo, Vol. I." His bird studies have been by no means limited to Africa, however, but include Europe, the Canadian Rockies and Panama. In 1934 he sailed the tropical Pacific waters in Templeton Crocker's *Zaca* to gather bird groups for the Whitney Wing.—The Editor.

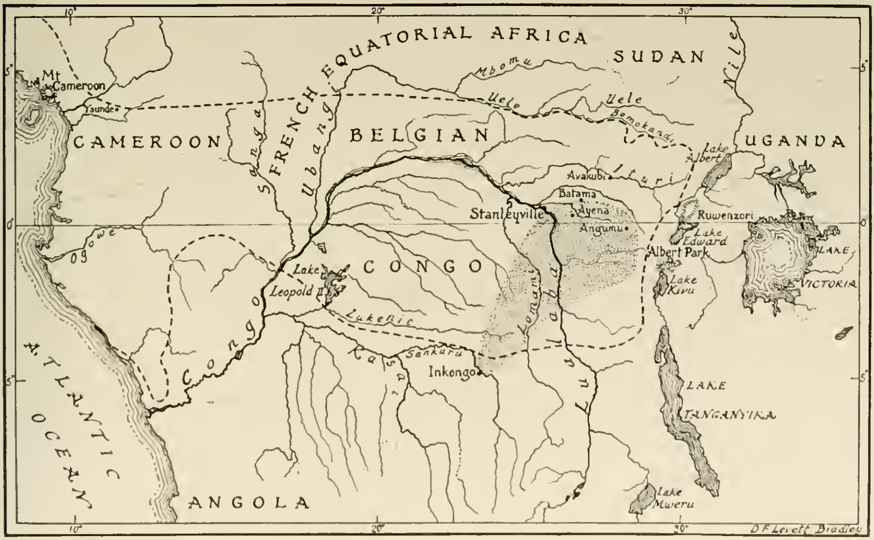
portant gold deposits, and organized companies for their exploitation.

The luncheon was certainly delicious, but I cannot remember a single dish we ate. All that mattered for me was that my host began to ask about a remarkable bird he had eaten in 1930, at his gold mine at Angumu, in the heavy forest close to the equator, between Stanleyville and Lake Edward. It was the only one he had seen in more than twenty years spent in the Congo, and had been killed in the forest by a native hunter. His description was remarkably suggestive of the blackish specimen at the Congo Museum, and he drew me a sketch to show the long narrow crest that rose vertically from its crown. Now there could be no further doubt that we were dealing with a great discovery, a typical pheasant with some slight resemblance to the Asiatic peacocks, at home in the lowland forests of the Congo.

The pheasant family is well represented in Africa by quails, partridges, and francolins, but thus far nothing had ever been collected there that could truly be called a pheasant, with metallic luster on its plumage. The bird so often called "peacock" in West Africa, or "faisan bleu" in the Congo, is merely a giant member of the turaco family, related to the cuckoos. This was all the more strange because in a number of other families of birds there are allied species or genera living in both southern Asia and forested western Africa.

My next step was to visit the Royal Museum in Brussels and examine all the different pheasants in the collection there. Our new African bird seemed a little more like a peacock than any other member of the family, though it had no ocelli on its plumage, and no long train. Its crest rose from the same part of the crown, and there was a close resemblance in the scutellation of the feet. While it had only a very small patch of bare skin above the ear, its upper neck was largely bare, with a scanty covering of downy feathers. The crown of the male exhibited one very peculiar feature, a patch of short whitish bristles just in front of the small black crest. There was nothing like this in the true peacocks, or in any other genus of pheasants.

I have spoken of the male as appearing blackish from a distance. But closer inspection showed it to be strongly glossed with violet on the lower neck, chest, upper wing-coverts and tips of tail-feathers, and with duller green on the back. The rufous bird,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UGANDA
Avakubi
Ituri
Batama
Stanleyville
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Ruwenzori
Angumu
Lake Edward
Albert Park
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LAKE
VICTORIA
Lake Leopold II
CONGO
Lake Kivu
Lukenie
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TANGANYIKA
ATLANTIC
OCEAN
ANGOLA
Lake Mweru
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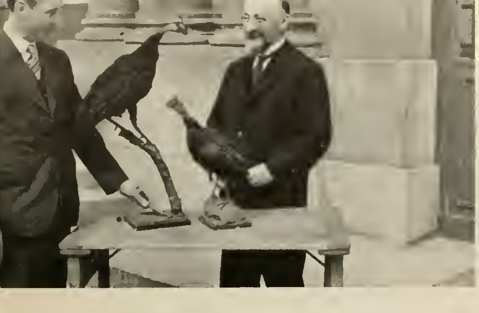
Congo Peacock Country

The probable range of Afropavo is indicated by the stippled area, only a small section of the whole equatorial forest, which is bounded by a dashed line. One reason for the restricted range of this newly identified bird may be its extirpation from a large part of the forest by natives

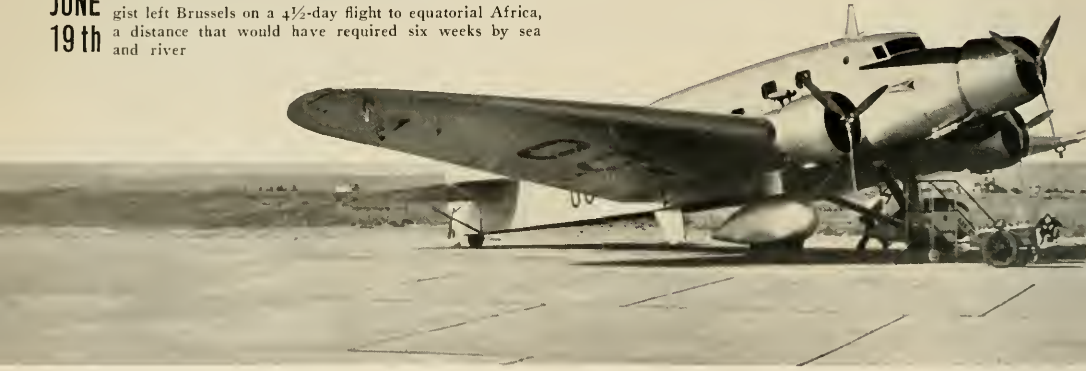


MAY 1937 THE TWO ORIGINAL SPECIMENS of the mysterious Congo peacock which had remained unidentified for 22 years: a photograph taken shortly before Dr. James Chapin of the American Museum flew to Africa to search for the living bird. *(At right)* Dr. Henri Schouteden, Director of the Congo Museum near Brussels; *(at left)* Mr. René Opdenbosch

THE CONGO MUSEUM IN BELGIUM where the unknown birds were noticed in a back corridor by Doctor Chapin, who discovered that their plumage resembled a feather which had defied identification for 23 years and had been plucked by him from the headdress of a Congo native

CONGO PEACOCK

JUNE 19th THE PLANE of the Sabena service in which the ornithologist left Brussels on a 4½-day flight to equatorial Africa, a distance that would have required six weeks by sea and river



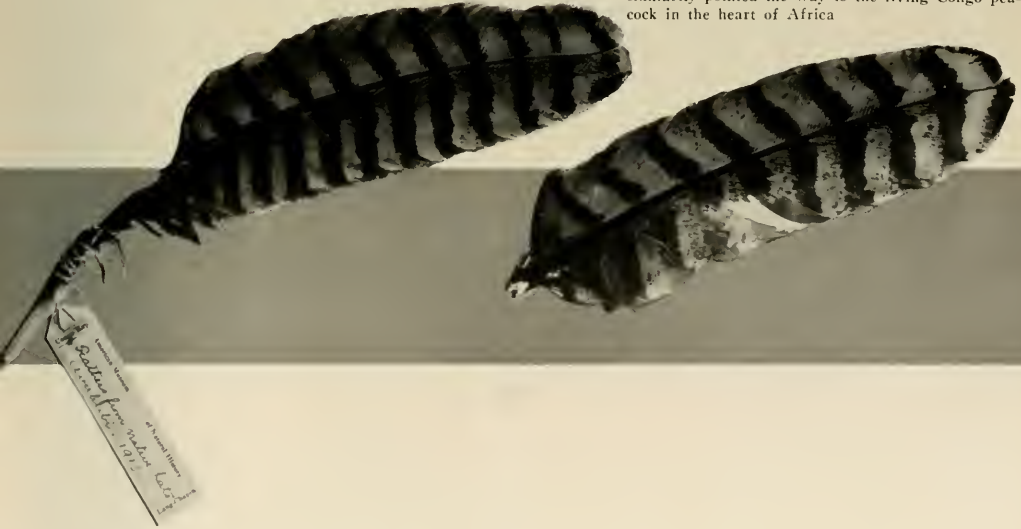
JUNE 23rd FISHERMEN AT STANLEYVILLE, in the geometrical center of Africa, where Doctor Chapin ended his flight and continued by automobile toward the portion of the dense equatorial forest where he hoped to find the Congo peacock

A TEMPORARY OBSTACLE on the road to Angumu. Before automobiles opened up central Africa, Doctor Chapin trudged for three weeks through this same forest in 1909 with a caravan of 160 porters

Bridgeless rivers like the Loya near Angumu are crossed on primitive ferries. Several boats are fastened together to support the car and are pulled along a cable

JUNE 30th **Angumu**: Headquarters of the "Somiba" or Bafwaboli Mining Company. Beyond, to the left, rises Mount Ogombo

1913-1936 *(Left)* **Wing-feather** taken from the headdress of a Congo native 24 years ago by Doctor Chapin. *(Right)* Similar feather that fell from an old specimen in Belgium. Their similarity pointed the way to the living Congo peacock in the heart of Africa



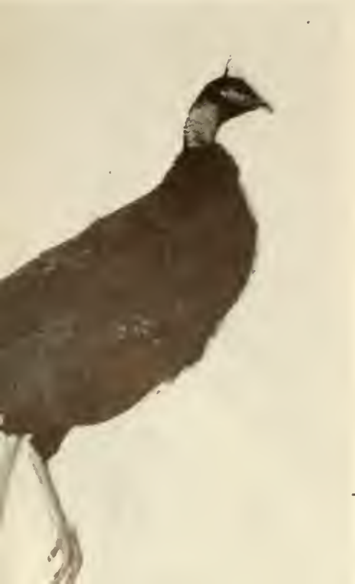
JULY 1st **Four skins** of *Afropavo* exhibited by Dr. Pierre Dyleff, medical man at the Bafwaboli Mining Company, Angumu, where he secured them shortly before Doctor Chapin's arrival

Doing his bit for the "gold standard": a Somiba workman in the placer mine at Angumu agitating gold-bearing gravel to separate the heavier precious metal

THE NATIVE SCHOOL of taxidermy organized by the author to facilitate the preparation of museum specimens of the Congo peacock

JULY 15th AYENA, an eight-months old clearing which proved more favorable for the hunt because of the proximity of the virgin forest

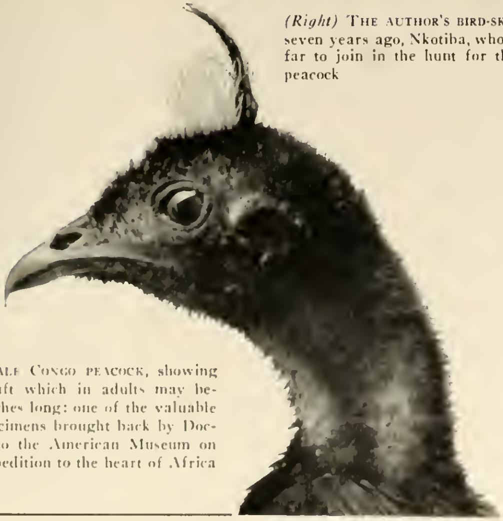
MONSIEUR and Madame Philippe de Braconier, who invited the author to Ayena and aided him greatly in making the acquaintance of *Afropavo* in its native haunts



JULY 18th THE PRIZE IS WON: a young male Congo peacock freshly killed at Ayena and photographed to show the form of the bird in the flesh. It is the first bird ever discovered in Africa that can be truly called a pheasant. Its feathers have a metallic luster, and it bears some resemblance to the Asiatic peacocks

(Right) After a successful hunt, Anyasi comes out of the forest with his dogs and the bird

(Below) A rather open spot in the virgin forest near Ayena, inhabited by *Afropavo,* showing buttressed roots common in most tropical forests



A young male Congo peacock, showing the crown-tuft which in adults may become 3½ inches long: one of the valuable scientific specimens brought back by Doctor Chapin to the American Museum on his rapid expedition to the heart of Africa

(Right) The author's bird-skinner of seven years ago, Nkotiba, who traveled far to join in the hunt for the Congo peacock

mottled and barred with blackish, had the feathering of the whole back brilliantly tipped with metallic green. I took it to be a female, mainly because it lacked spurs, though apparently adult. By softening the skin of one of its wings I was able to uncover the bones corresponding to our hand and see a little protuberance on the second metacarpal which distinguishes the pheasants and other members of their family from the guinea-fowls.

With the generous encouragement of Doctor Schouteden I continued my studies. A secondary from the female specimen was mailed to Doctor Chapman in New York, who compared it with my feather of 1913 and found a close agreement. Avakubi is only 105 miles north of Angumu, and my feather may well have been brought from the southward.

In November, 1936, my article describing the Congo peacock appeared in the *Revue de Zoologie et de Botanique Africaines,* and the bird was given the name *Afropavo congensis.* A little later another account in French was published in the *Bulletin du Cercle Zoologique Congolais,* which has a wide circulation in the Congo. A brief mention appeared in a Brussels newspaper, and now we awaited news from people in the Congo who might be acquainted with the bird there.

An expedition contemplated

It seemed advisable to have a painting made of *Afropavo,* and funds were provided by Dr. L. C. Sanford. In December I took the types to England and left them with George E. Lodge, who was to paint them. Many of my friends had already asked me if I did not long to go back to the Congo to see this new bird alive and to secure additional specimens. But I had my book to write and I did not think it would be possible to take the time needed for such a venture. It was in London, while talking with Lincoln Ellsworth, that a plan suggested itself.

Whether I would have any chance of collecting the Congo peacock in the brief time I could devote to the search was very doubtful. But the bird certainly lived in the forest about Angumu, and in six weeks I knew I could train a few natives to make birdskins. Mr. de Mathelin had assured me that Dr. Pierre Dyleff, the medical man of the mining company at Angumu, would do everything possible to help; and this mining camp could now be reached in about six days from Brussels by airplane and automobile.

I applied to the American Museum for permission to go to the Congo, and my request was granted on condition that I first complete the writing I had to do in Belgium, and that I stay not more than two months in the Congo. So now I could look ahead, plan my trip, and watch developments. A few reports began to come in from the Congo. One man claimed that birds resembling European pheasants had been shot in the forest of the Lower Uele district. Another related that he himself had shot a number of Congo peacocks in somewhat the same region. But when he did not show enough interest to come from Brussels to Tervueren to see the actual specimens, I decided to keep my attention focused on Angumu. The Congo Museum had many native hats adorned with feathers from the Lower Uele, and not one plume of *Afropavo* could be found on them.

Further clues

The Reverend Thomas H. Wilson wrote Doctor Schouteden from Inkongo in the Sankuru District that he had once collected an example of our bird, but at first I was skeptical. Although I believed the types had come from that district, Inkongo seemed a little too far south of its really heavy forest.

At length there came a letter from Mr. R. Geldof, a police officer in the Congo, saying that in 1930 he had shot a specimen along the railway, 50 kilometers south of Stanleyville. He had had it mounted, and it was in the home of his sister at Eecloo in Belgium. With his authorization Doctor Schouteden sent for the specimen, which proved to be a fine female, the third known.

During this time I had been in communication by air-mail with Doctor Dyleff at Angumu. He assured me that specimens could be secured there, but he had no experience in skinning birds. I recalled that Musoba, a native I had trained in this work in 1926 was employed by the Albert National Park in the Kivu District, so I asked Professor Van Straelen, President of the National Parks Commission, if Musoba could not be sent to Angumu to assist Doctor Dyleff. My request was granted, and my former skinner traveled from Rutshuru to Angumu in the second half of March, 1937.

It now became clear that I would be ready to leave Belgium some time in June. All my friends had grown enthusiastic about the project, and three of them offered me financial assistance sufficient for all needs, though travel by air is necessarily somewhat expensive. These generous Americans were Mr. Charles W. Boise of London, Mr. D. Heineman of Brussels, and Mr. W. Hallam Tuck of Waterloo. Dr. Leonard C. Sanford also offered his support if I needed it.

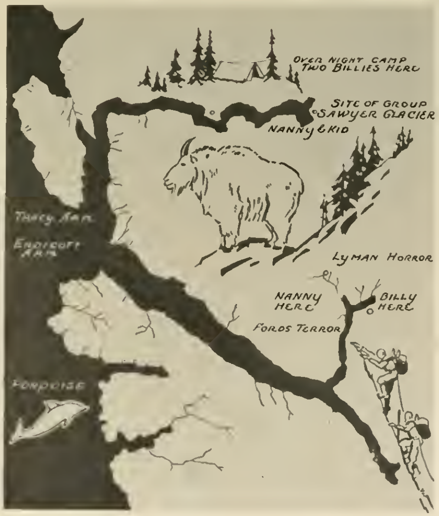
I was careful always to explain that I could not

Continued on page 777

UP-STREAM FOR MOUNTAIN GOATS—*After wading through frigid Alaskan streams, clambering up waterfalls, and scaling perilous cliffs, the Clark-Kissel Expedition secured fine specimens of these hardy animals*

By HAROLD BENJAMIN CLARK

WE GOT our first look at the *Westward* the evening of August 8th, as she lay moored to an oil-dock float in the harbor of Ketchikan, one of the seaports in Southern Alaska. She was a trim, white, Diesel-driven yacht which we planned to make our home for the next month during an expedition through the coastal waterways of Southeastern Alaska, to collect specimens for the Mountain Goat Group in the new North American Hall at the American Museum.*



From the first we found Captain James MacDonald most helpful in every way, he was not only a skillful navigator but planned most efficiently for our comfort and happiness. At four next morning we left our moorings beside the "oil docks" and by eleven were busy on our first mission of collecting. In Behm Canal we saw our first school of black and white Dall Porpoise. John Lyman who acted as Chief Hunter of the Expedition shot one of them from his station at the *Westward's* bow. Instead of small shot, the cartridge was charged with a barbed dart attached to a coil of tarpon line. The dart caught the porpoise in the middle of the back, a good piece of shooting when you consider that the fish is visible at the surface for less than a second at a time. We had a dinghy overboard in no time. Mrs. Clark played the fish with an 8-ounce tarpon rod, and it gave her a good stiff fight as she followed it in the dinghy. Three times it charged and struck the small boat. We were a bit worried as we watched from the yacht, but after an hour's battle she (for it turned out later to be a female porpoise) died in the middle of her final charge, floating close to the dinghy.

In these same waters we took another female porpoise, and Gardell Christensen set about preparing them both for shipment back to the Museum. Chris was in charge of preparing our specimens, but he objected to being put down in our records as a taxidermist. Being a finished craftsman in the Museum's Preparation

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* See Dr. James L. Clark's article "Re-Creating the American Wilderness," page 739.

HAROLD BENJAMIN CLARK, patron of the American Museum of Natural History and donor of the Mountain Goat Group in the new Hall of North American Mammals, tells in the article above, the story of the Group's collection. With Mr. Clark on the expedition were Mrs. H. B. Clark, Miss Abbey Kissel, co-sponsor, Mr. John Lyman, in charge of hunting, Gardell Christensen of the Museum's Department of Preparations, and Mr. Joseph Guerry, Museum background artist.

Department, that term would give only a limited idea of his range of skills, so we all sat down together and figured out a title that Chris would find more fitting to his station. We finally evolved "Tassodermatologist," which Chris, after examining the Greek derivatives, decided was exactly what he wanted.

Miss Abbey Kissel acted as his first assistant and the result was such that the sea gulls surrounding our boat, although hardened to odors of all kinds, now veered away as they neared the *Westward*. We cruised leisurely up Chatham Strait as far as Pablov Harbor, anchoring at the mouth of small streams where with our light rods we caught cutthroat and Dolly Varden trout from one to five pounds in weight. About this time we reached Petersburg where we picked up our guides, Oscar Oberg, V. F. ("Red") Williams and Ralph Wooten, and then pushed on to the goat country.

The first kill

We were all fascinated as we headed northward by the miraculous change in the coloring of the water. If you have never seen glacier water, it is something to look forward to. This water does not always mix with ordinary sea water, depending on the currents, but tends to flow in a clearly distinguishable stream of its own, an intense, harsh green in color. The air grew colder, the forests lower as we came to the more rocky mountains; the mists became heavier, and when they lifted we could see the ice-topped mountains and the magnificent purples and blues of the lower hills.

On August 19th, we anchored in the north arm of what is known as Ford's Terror. It is well named: a steep, narrow gorge, with extremely slippery walls. Christensen and John Lyman, who held the title of Chief Hunter throughout the expedition on pure merit, climbed the North Cliff with two guides and equipment for a two-night camp.

The only possible route for scaling these rocky peaks is up the course of the glacier-fed streams, as an interlacing covering of alders makes all dry trails impossible. Climbing up slippery rock faces and under waterfalls was new to all of us. Abbey Kissel, Oscar and I hunted lower down on the south branch. We saw no goats except a nanny and kid and after a half day's climb, we returned to the *Westward*. John Lyman and Christensen made camp on their cliff which we afterward named "Lyman's Horror." Because of the difficulties of climbing, ropes were used in many places.

On their afternoon hunt, John Lyman saw and took successful aim on a 10¼-inch billy. This was our prize specimen, and will later be exhibited in the Mountain Goat Group in the new North American Hall of the American Museum. Unfortunately later that day a dislodged stone rolled down and injured the foot of Wooten, their guide. Christensen took the skin and skeleton of John Lyman's goat and next day they climbed down to the *Westward*. Christensen and John Lyman deserve great credit, for on this return journey, in order that Williams should be free to help Wooten, they carried all the equipment between them. This meant climbing down 6000 feet with individual packs weighing fifty pounds, with coats and guns added. They reported having seen several more billies within range, but as there was no way of bringing them down the capes, no more shooting was attempted.

Oberg and I climbed the left branch of the waterfall with Mrs. Clark, Abbey Kissel, "Cappy," Joseph Guerry, and first mate Dale Kinney. While the rest ate lunch in the alder flat at the top, Oscar, Cappy and I stalked a goat we could see taking a noonday nap under a small glacier at about 4500 feet. There was a small stream to follow and we went as far up it as we could. When there was no chance to go on, I took a long shot, (Cappy and Oscar said over 700 yards), and by good luck made a hit, breaking the goat's neck. It proved to be a barren nanny with a 9¼-inch horn. She lay on a new slide, where the going was exceedingly ticklish. The best we could do without Christensen's expert help was to bring down the hide, feet and skull of the specimen.

"Submarines" of ice

Next day we turned up Endicott Arm to the end of Tracy Arm, which to be in keeping with these colorful Alaskan place names, we christened Tracy's Fright. We pushed our way through ice floes and anchored again at the foot of a waterfall whose current was supposed to keep the ice at a safe distance. Our anchorage was about two hundred yards from the right branch of the enormous Sawyer Glacier. All day long there was an intermittent booming as large icebergs fell off the face of this glacier, "submarined" under water and then came up suddenly in the wash of small tidal waves.

Abbey Kissel went down to bed early to be ready for the start at five next morning, but in a moment came rushing up, hair flying, trying to tell us of a mass of ice which seemed about to overwhelm the *Westward*. We all jumped for poles to fend her off and our engine was started in a hurry, but the ice passed after pushing the *Westward* within an uncomfortable ten feet of the rocks. Next

Up-Stream for Mountain Goats

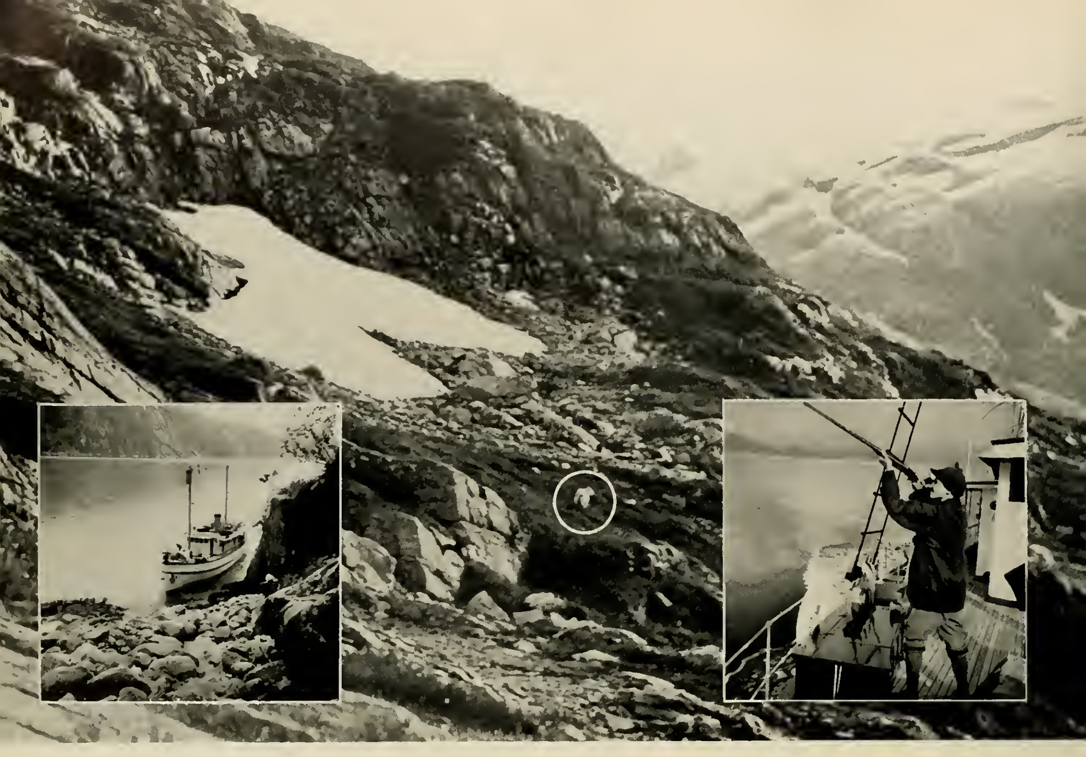
By HAROLD BENJAMIN CLARK

(Above) 25-MILE LONG Sawyer Glacier entrenched among the jagged mountains of Southeastern Alaska. In rugged country like this the Clark-Kissel Expedition climbed sometimes as high as 6000 feet stalking the elusive Mountain Goat, specimens of which they brought back to the Museum for exhibition in the new Hall of North American Mammals

(Below) CO-LEADER ABBEY KISSEL (right) trolling for porpoise with John Lyman, chief hunter

(Above) LEADERS AND SPONSORS of the Expedition were (left to right) Abbey Kissel, Mrs. and Mr. Harold B. Clark. They are shown on the yacht *Westward* holding the flag now being considered for an official Museum Emblem

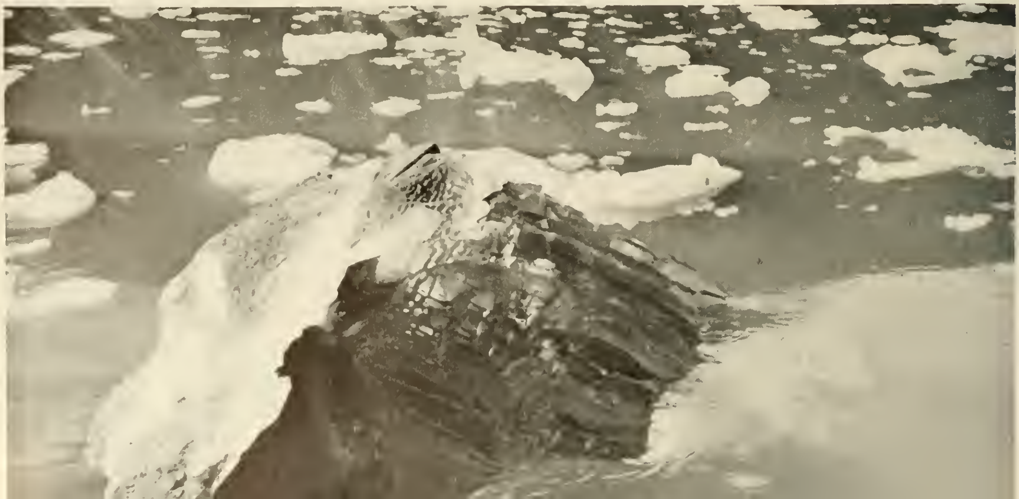
(Below) DALL PORPOISE: a specimen for the Museum taken by Mrs. Clark after a thrilling one-hour struggle



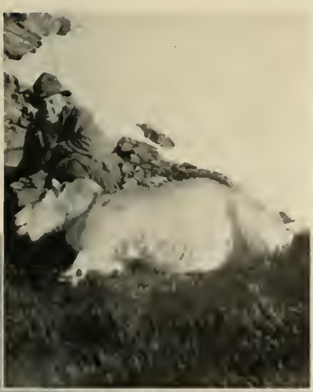
(Above) Atop Ford's Terror: the precipitous gorge where the party shot their first goat. The goat (in circle) can be seen trotting easily on the craggy terrain over which the hunters stumbled, sweating under heavy guns and equipment. The yacht *Westward* shown at anchor *(left insert)* was the expedition base camp throughout.

Although she had never fired a rifle before coming to Alaska, Abbey Kissel *(right insert)* learned quickly and made the best record of the party. She shot the second largest goat, one of four brown bears and two of four black bears taken for the Museum after collection of the goat group

Not lava but dark blue ice. Glacier ice like this fragment, which has been long in forming, sometimes takes on a clear bluish tint, which is intensified by reflected light from sky and water. Much larger bergs than this split away from the main glaciers and "submarined" beneath the water surface, emerging suddenly. Members of the party lived in dread lest one of them "torpedo" the yacht, but although they rose on every side, no such calamity occurred



(Above) THROUGH THESE WATERFALLS and cascading mountain streams lay the only passable route to the towering peaks where the goats make their home, the thickly forested cliffs on either side of the streams being impenetrable by hunters with heavy packs. A few days of this sort of work in a damp climate left the Expedition without a dry piece of clothing to its name. Once past the stream's source, the hunters had to climb dangerously sheer precipices. During the hunt at Ford's Terror, a guide's foot was smashed by falling rock



(Left) THE BILLY GOAT slated for immortality as central figure of the Mountain Goat Group

(Below) "LYMAN'S HORROR," expedition nickname for this barren peak where the billy met his death. Huntsman John Lyman *(right insert)* made the kill at 50 yards—the shortest shot of the expedition

morning we four hunters, Abbey Kissel, John Lyman, Christensen and I, with Oscar and "Red" climbed the stream on the right of the glacier and hunted up to 6300 feet. We saw no goats on top, only some nannies and kids at a great distance on the way up. The guides believed the goats had fed in the bright moonlight of the night before and slept all day hidden in the alders.

Abbey gets her billy

We climbed back down, reaching the *Westward* about six. One of our troubles was that on sunny days the snow banks on top melt fast and the stream bed we climbed fairly easily in the morning would become a roaring torrent by mid-afternoon, brown with silt, and shoulder deep. Again and again we had to cross and recross, by jumping from one fairly big rock to another, usually soaking ourselves with each take-off and landing. Anyone who tells us that ascending and descending six thousand feet, climbing up and down for ten hours on rock all the way is not punishment no matter how fit you are, has just never hunted goats. In a field book which we had it was stated that all mountain goat hunters really needed were "big lungs and a strong pair of legs." But we all agreed on an amendment to that statement which we respectfully offer; namely, that the qualities indispensable to the goat hunter are a suicidal tendency and a weakened mind.

Next day Christensen had a chance fairly well down and did some superb shooting, getting a nanny and kid, both at over 500 yards. We had a special permit to kill the kid, for purposes of Museum exhibition. Then our good weather turned to mist and rain. Furthermore, Wooten's injured foot had failed to respond to treatment, the swelling having, if anything, increased. We therefore, decided to steam northward to Juneau where we got him to a hospital. X-rays showed a broken bone in his instep, so we had to look around for another guide. After locating a substitute and getting Wooten, his foot now encased in a plaster cast, back on board, we returned to Tracy Arm. The ice we now found too dense to buck so we anchored half way up the arm and five miles from the glacier. We all wanted Abbey Kissel to kill a goat and we organized accordingly. With John Lyman and Abbey Kissel as hunters, Oscar and "Red" as guides, and Christensen, Guerry and Dale as packers, a 6,000-foot "hog back" was climbed, on top of which the party, after hunting, passed the night.

Abbey Kissel killed a fine billy 9¼ inches and John Lyman one 8½ inches. They came on board at six next morning after a cold damp night on top. Everyone was proud of Abbey Kissel who had done her full bit all the way, starting from scratch. The remarkable thing about it was that she had never fired a rifle in her life before joining this expedition.

I made a fruitless climb with our substitute guide one day, and on another, Christensen and I tried to stalk a goat which had come fairly well down. But the going was so slow that before we had climbed a thousand feet, the goat had gone up and out of the canyon. Although the billies notoriously remain high up except during the mating season, we wondered why we found so few goats at low altitude until one day we saw in a space of half a mile four black bears, which are almost never found in this section. We had a few days left and this sight turned our minds to bear hunting.

After leaving Wooten at his home in Pybus Bay, our first bear party, consisting of John Lyman, Christensen, Abbey Kissel, and I, each with guide, went ashore to hunt. Bear hunting was a new and different game. You go ashore in the dark before dawn and land in a salt marsh at the mouth of a creek where the bears are feeding on the salmon which have come there to spawn and die in vast numbers. All day you work up the creek until you find a bench where the bear has fed the previous night. There you try to pick a post from which you can look up and down stream and at that place you wait for the coming of the bear until it is too dark to see the front sight of your rifle. You are wet all day and sit for hours in dampness. It is imperative to keep absolutely still no matter how many mosquitoes and "no-seeums" are devouring your hide. For company you have the gulls, the ravens, and an occasional eagle, waiting like you for the bear to come and kill. The bear eats only the flesh of the salmon leaving head, entrails and skeleton for the scavenger birds.

Bear hunting

Once in a while a mink and sometimes a deer comes along, and if you remain motionless they will look you over and then quietly melt into the forest.

We hunted fourteen creeks, in all, and killed four brown bears. John Lyman had a battle with his, and it took five shots to bring him down for keeps when the charging animal was only about twenty feet away. Christensen and I also worked hard for our bears, but Abbey Kissel went ashore the first night and shot her bear as she'd buy a gown—just saw it and shot it and hurried back to steal the first hot bath in our one bathtub. It seemed all very simple to her. Later on we went out after black bear and Abbey got along just as effortlessly,

Continued on page 782

RE-CREATING THE AMERICAN WILDERNESS—*Expeditions begin a broad program to immortalize scenes rapidly vanishing from our continent: first steps in the North American Hall of Mammals*

By JAMES LIPPITT CLARK

Director of Arts, Preparation and Installation, American Museum

ONE would hardly believe an old she-grizzly would attempt to defeat a Museum expedition, but she did!

For the love of her two fluffy little cubs, she took a long chance and might have been killed, had we not left our guns back in camp.

But the cause which brought this all about is interesting. Here in our Museum there has come a realization that in spite of our deep interest in the wild life of the world, we find that right before our very eyes our own wild life is fast disappearing, and we are, at this eleventh hour, turning our thoughts to a hall of our own North American mammals; that before it becomes too late we may collect and create a hall of colorful habitat groups that shall be second to none.

In spite of the beauty and finesse of the South Asiatic Hall and in spite of the magnificence and color of the Akeley African Hall, we are going to make our North American Hall even finer, even more beautiful. With our thoughts now turning toward this panorama of our own animal life, there is much to be done; so much, in fact, that it may take five years before this hall is completed.

For the last ten years we have been thinking and talking of this hall. For the past five years the hall has been built and reserved for this display. And for the past five years floor plans of case arrangements have been made, discarded and made over again—not one or two, but dozens, in our constant search for the best general arrangement.

One may wonder why this long preparation. Our Museum is vast in its activities. Many things are going on at one time, and even a great new hall is but a part of our many activities. Had we not had what we call "the depression," our American Hall would be farther on its way. Not only were we retarded by this psychological impediment, but our city administration, whose pleasure and duty it is to furnish the cases, also suffered some embarrassment.

President Davison had appointed our new Trustee, Mr. Robert E. McConnell, Chairman of the Committee of the Hall of North American Mammals and Collections. Under Mr. McConnell's leadership the whole program was revived and crystallized. Last year Mr. McConnell headed the first expedition for North American Hall, primarily as a reconnaissance for the rather pretentious collecting program he was to inaugurate. Although some material was collected, much important work was done in laying plans for our field work of this year, when two expeditions were organized and sent forth. The first to leave New York was the Clark-Kissel Alaska Expedition, which will be told of elsewhere in this issue of NATURAL HISTORY.

The second, in which the writer participated, left New York with staff associates on August 28th, to be joined later by Mr. McConnell. The first stop

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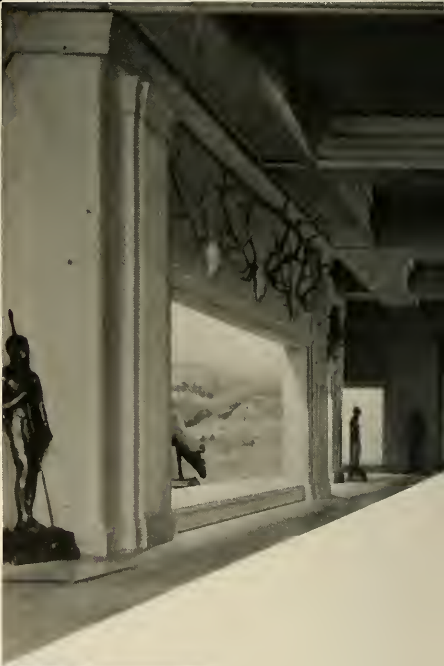
JAMES LIPPITT CLARK, celebrated huntsman-explorer and one of America's topmost animal sculptors, has been for fifteen years head of the Museum's Preparation Department. His extraordinary talents, both as creator and as collector of animal habitat groups, have given tremendous impetus to the Museum's vast program of building permanent replicas of Africa's dwindling wilderness and that of other continents. Doctor Clark is also a competent motion picture engineer, colorful lecturer, and author of many illuminating magazine articles besides his book—*Trails of the Hunted.*

In 1930 he was awarded the Speyer Memorial Prize for sculpture, which art he practices in his own studio as well as at the Museum. Born in Providence, Rhode Island, and a graduate of the Rhode Island School of Design, Doctor Clark early became interested in museum work. He went on his first expedition (Dugmore-Clark African Expedition) in 1908. Since then he has led or participated in several expeditions to Africa, Asia and in Western America.—THE EDITOR.

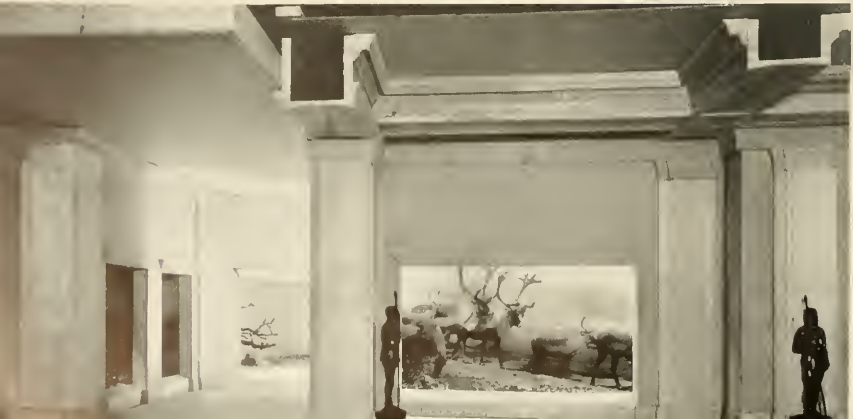
Exploring at home: an American Museum expedition loads its truck for the season's explorations toward the re-creation of the American wilderness in a Museum exhibit hall

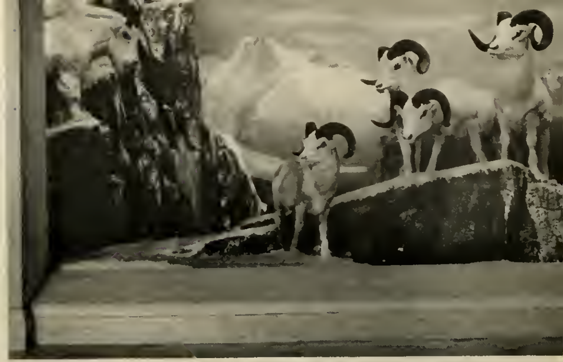


First Steps in a North American Hall of Mammals

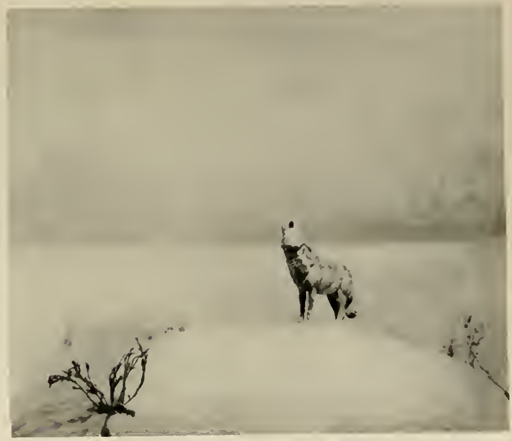
(Right and below) The hall in miniature: two views of the models, made as a preliminary step in the constructing of an elaborate hall

Many years of planning have already gone into the creation of this hall, which will immortalize scenes rapidly vanishing from our continent



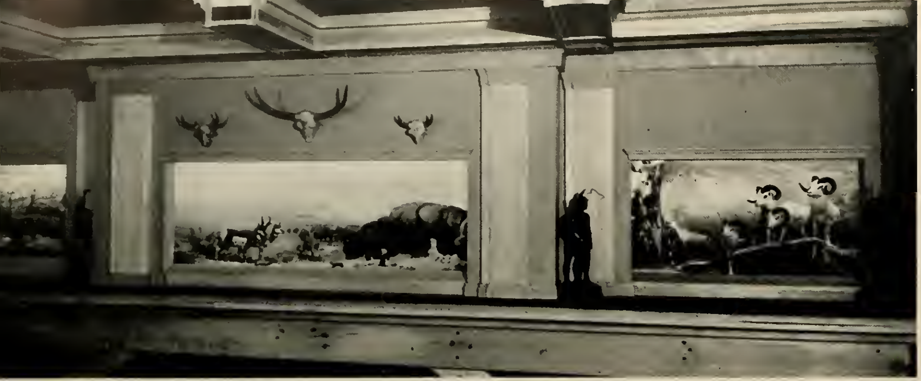


(Above) Miniature model of the Mountain Sheep Group, one of the twenty-nine groups planned for the Hall of North American Mammals. Alaska, Canada, and many sections of the United States will be represented



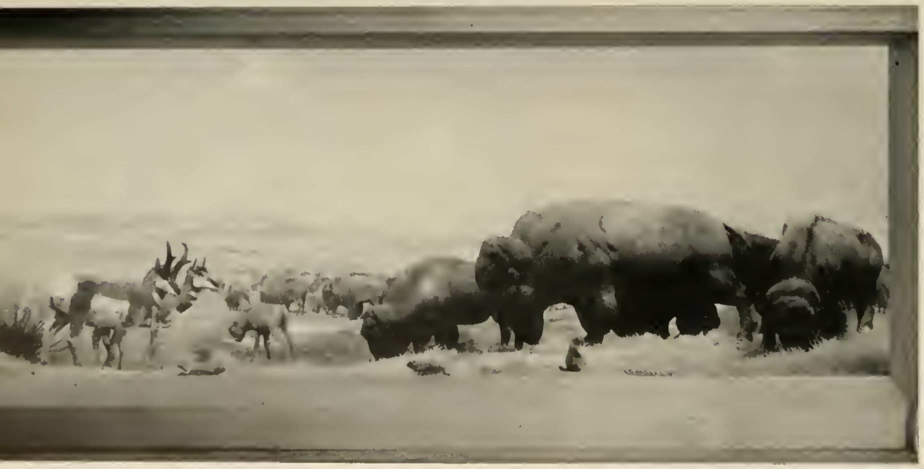
(Above) Sketch design for the Coyote Group: bringing in the drama of a lone coyote in the snow, howling in the moonlight

In artistry and popularity the North American Hall of Mammals promises to rival the celebrated Akeley African Hall



(Above) A FIRST STAGE IN THE CREATION of the Bison Group: each group must be considered in its relation with the others, and great care is exercised in the selection of localities to achieve the maximum educational value

(Below) DETAIL OF MODEL which will guide the preparators in the construction of their life-like scene. The miniature bison below are about six inches high

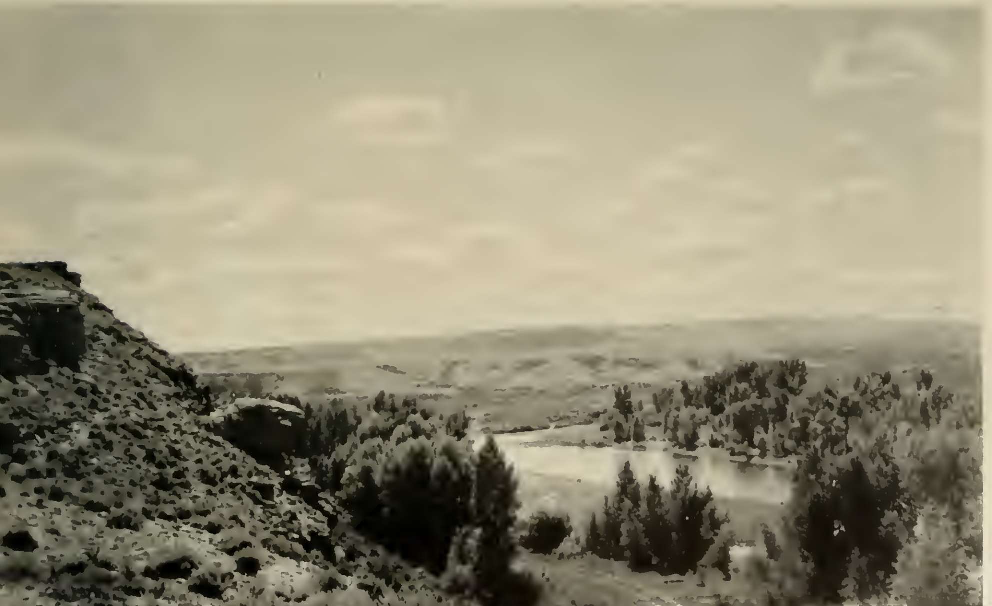


(Left) JAMES L. CLARK, head of the Department of Preparation in the Museum, reconnoitering on last summer's Western expedition which secured specimens, background, and accessories for the Bison and Elk Groups

(Above) Robert E. McConnell, with a fine antelope which he collected for the Bison Group

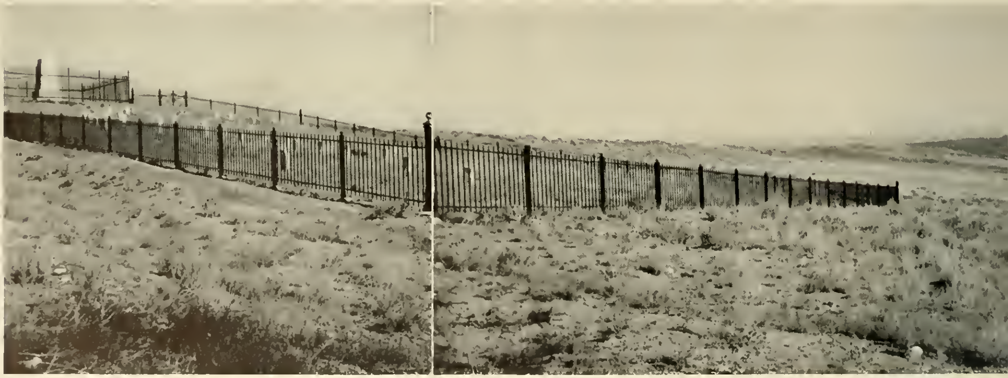
(Above) Doctor Clark prepares some of the antelop skins in the field, with the "help" of the cowboy guide

(Below) A historic spot which may be selected for the setting of the Bison Group: where the covered wagons trekked the Overland Trail and crossed the North Platte River on their journey westward



(Right) George Petersen of the Museum's Department of Preparation collecting typical vegetation which will be "transplanted" in the Bison Group

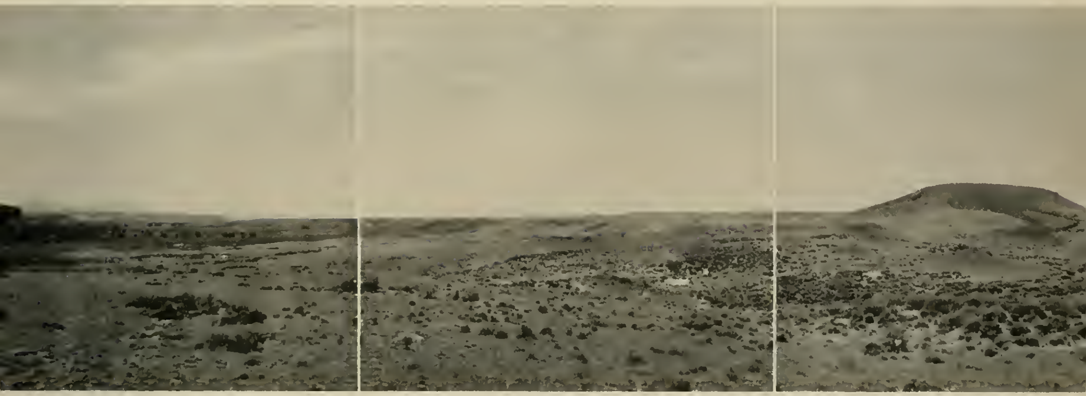
(Above) Hanson Puthuff, artist, recording in oils the landscape coloration for one of the backgrounds. This painting will be enlarged, its perspective adapted to the curved background of a group and installed in the Museum with the reality of a scene viewed through a window



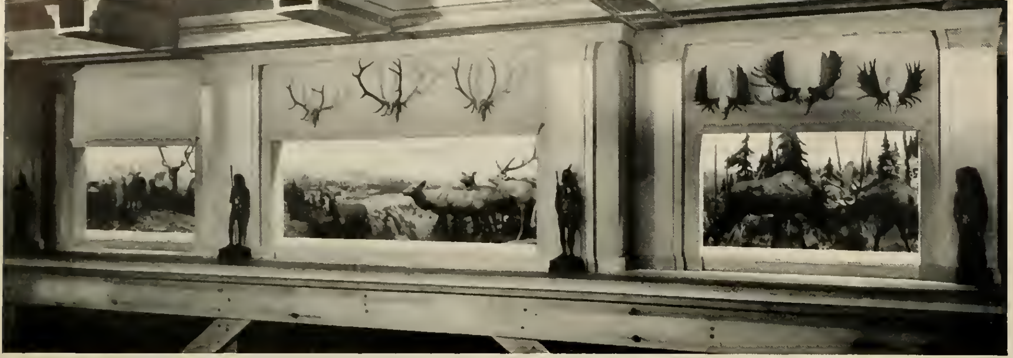
(Above) Photographic panorama of Custer's Battlefield, a section of the West interesting both to historian and naturalist

(Right) George Petersen making detailed photographic study of the topography, geology and vegetation of a spot to be reproduced with scientific accuracy for the benefit of those who may never see the actual country

(Below) PANORAMIC PHOTOGRAPH of the site where the old Overland Trail crossed the North Platte: a record which will aid the artist in transferring the details of the historic landscape to the background of an animal group

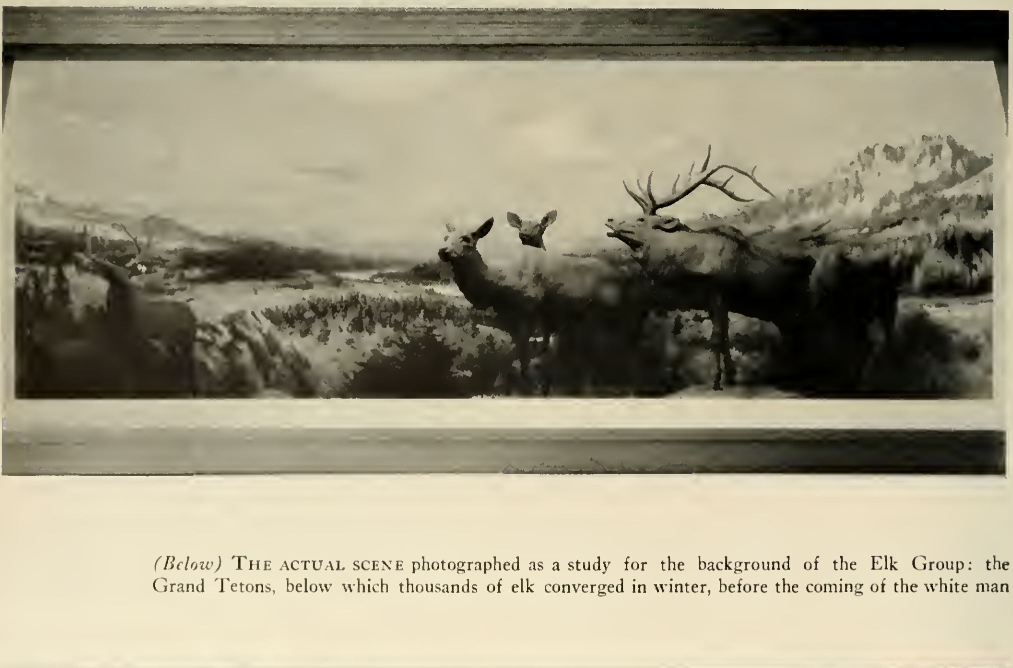


IN ADDITION to historic sites many national parks will be selected as settings for the exhibits in the American Museum's new Hall of North American Mammals, thus providing scenes that are not only conspicuous for their wild life and beauty, but familiar to many



(Above) SCALE MODEL of the Elk Group which was an objective of last summer's expedition under the combined leadership of Mr. Robert E. McConnell, Chairman of the Committee of the Hall, and Dr. James L. Clark, head of the American Museum's Department of Preparation

(Below) DETAIL OF MODEL which assisted the field party in the proper selection of setting and specimens



(Below) THE ACTUAL SCENE photographed as a study for the background of the Elk Group: the Grand Tetons, below which thousands of elk converged in winter, before the coming of the white man

Elk country: a typical scene in the region where Mr. McConnell and Doctor Clark selected specimens for the artistic and scientific exhibit

Low-hanging clouds fill the valleys of the Elk country, above which the sun shines in a cloudless sky

Mr. McConnell on his hunting pony scans the hillsides for elk

Elk camp, nestled in an amphitheatre of tall spruce, from which the party radiated to hunt their elk specimens

The camp cook welcomes the returning hunters at the end of long, hard days spent in the interest of the American Museum's Hall of North American Mammals

was at Elkhorn Ranch, North Dakota, where Theodore Roosevelt lived as a ranchman. After collecting group material from this location, to be installed in the Roosevelt Memorial Building of the American Museum, the party moved to Billings, Montana, and started the collecting for North American Hall and continued for five weeks, covering some 2500 miles within the borders of Wyoming.

An extensive program

One objective of the expedition was a reconnaissance of certain historical sections of the country, to select a suitable background setting for the Bison and Antelope Group, to be the gift of Mr. McConnell; then to proceed south and collect specimens of the pronghorn antelope for the Bison and the Roosevelt Ranch Groups.

The buffalo were not to be collected at this time but later in the season, when their coats are in better condition, under special permission from the United States Biological Survey to take specimens from their large herd at Missoula, Montana.

Another phase of the expedition was the collecting of specimens for the Elk Group. Through the deep interest and generosity of Mr. W. L. Honnold, who lives in the West, we were, while in the elk country, to get certain background studies and accessories, to be held until we could study some typical elk country in northern Colorado as an alternative setting.

To accomplish all this much traveling had to be done. September was the proper month for the most colorful backgrounds and for the skins and horns, which at this time would be out of velvet. Mr. McConnell was to join us about the middle of September and take an active part in this collecting. In the meantime there was much that could be done in visiting certain areas and getting such studies and material as time would permit for the other groups.

There are many factors which influence the selection of a group. A single group is but a unit of the whole hall and must always be considered in its relation to the others. Only in this way can the story of animal life throughout the North American continent be properly told. A hundred groups could easily be made, for not only do we show the big animals, but the lesser ones as well. Yet there is room but for a quarter of that number, so a careful selection of representative types, with their typical settings, must be made.

In a North American Hall we must take in Alaska, Canada and various parts of the United States, from Maine to California and Washington to Florida, showing mountains, plains, deserts, woodlands, marsh and grass lands. For we also conceive our groups to show the botany, as well as the landscape, geology and fauna. In this conception our groups become basically educational, as well as beautiful.

Wherever possible, it is further planned to use national parks as background settings. Our national parks have not only been set aside for their grandeur and beauty, but also for the wild life they contain. What better could we do than use the Grand Canyon for the Mountain Lion Group? The Bad Lands for the Mule Deer, Jasper National Park for the Bighorn, and the Yellowstone for the Grizzly Bear? Many people have visited our parks and know them well. When they see a familiar scene as a background, they know it is true; and when they view another scene—of Alaska, Canada or the Southwest—they know it also has been executed with the same fidelity.

With this thought we headed for Wyoming, the last stand of the wild buffalo, to study the possibilities of Custer's Battlefield, on the Little Big Horn River, for a typical buffalo background, and followed the Overland Trail to where it crossed the North Platte, where the sturdy pioneers wound their way in covered wagons.

At Billings we bought a small truck and piled in with bed-rolls and baggage, "trekked" the rolling country over fine roads, leaving them when necessary to top a hill for a better vista or to cross a valley.

Mr. Hanson Puthuff, of California, was the artist selected to make the background studies, and with easel perched high on a knoll or atop the truck, he made, in record time, color studies of the scenes before him. While the paintings were being made, Mr. George Petersen, of the Department of Preparation, collected sage brush, grass, rocks and soil, while I photographed flowers and contours and studied details for our group design.

From Billings we went to Cody, which was the center of operations for the duration of the expedition, and thence headed south to the spot where the old Overland Trail crossed the North Platte. Here Mr. Puthuff continued his painting, while Petersen and I carried on the other work.

In the Grand Tetons

Swinging north again, we headed for Pitchfork, where we were to meet Mr. McConnell and collect the antelope specimens. Here on the flat mesas along the Gray Bull River, where a considerable band of antelope still survives, we rode the hills and crawled on our bellies in pursuit of those elusive creatures.

Here the Grand Tetons, now a national park, tower their majestic peaks high above the lowlands which form the great basin at their eastern base. These flat lands were, before the white men took them over, one of the elk's greatest wintering grounds. From the hills around, thousands of elk converged to spend the winter. Here they found an abundance of food, enough to last them until spring, when again they took to the hills.

The Tetons provided one of the finest backgrounds to be had, and one to be seriously considered, yet there were equally typical settings for the elk in northern Colorado. At Jackson's Hole, Petersen and Puthuff were to get studies showing the rich autumnal colorings and then wait for the equinoctial storm, which would cover them with snow, when they would get further studies with the hills under their white blanket. These were all to be alternatives for future consideration.

Mr. McConnell and I continued our battle of wits against the lovely but wary antelope, and were lucky, for within a week we had our desired number—male, female and young, with complete skins and skeletons.

Elk country

Returning to Cody, final arrangements were made for our trip into the elk country in the northwestern corner of Wyoming. As elk range considerably, and they are one and the same kind from Montana to Colorado, it made little difference where the specimens were actually secured. A 50-mile motor trip took us over a range of mountains and down into Sunlight Valley, where a truck with supplies waited to carry us on for another fifteen miles. There, at the end of the road, we changed to saddle and pack horses and journeyed on, up the lovely valley of Crandall and Timber Creeks for another twenty miles. Here, by the side of a bounding stream, nestled in an amphitheatre of tall spruce, we found a snug and cozy camp all set up.

The hills ran rugged and steep, covered for the most part with a growth of heavy spruce and fir except where recent fires had left large areas of burnt timber. Across the creek to the south, the wooded wall rose steeply to nearly 12,000 feet, where it was topped with our most prominent landmark, Papoose Peak. From my tent I could look up and watch its glistening snowy summit, which each evening was glorified by a delicate rosy pink from the setting sun, just before it dipped below the Great Divide.

In such a setting we were to hunt our elk—bull, cows, yearlings and calf. It was quite different from hunting the hot flats of the antelope country. Now we were in high, cold, rugged hills, covered with deep, mysterious forests.

Our first days were spent in reconnoitering to find where the elk were most likely to be. The Wyoming Game Commission had generously issued a special permit for this work, as they had for the antelope, but even with this there was no margin in numbers or kind, and no mistakes could be made. The first day Mr. McConnell and I separated, each hunting with a guide in different directions, and each to collect, if possible, only certain specimens we had agreed upon, so there would be no duplications.

Animals scarce

For two days we went from early morning until dark without success. Very few elk were seen, and then only at long distances. Many tracks were about, but they were mostly of bulls, apparently young bulls ranging considerably, for this was the beginning of the "rut," and they were looking for cows which they could round up and hold for their own. Locating the elk was further made difficult because of their nocturnal habits, which keep them secluded in deep timber during most of the daylight hours.

When we first arrived, some bulls were "bugling," but after a few days they ceased and we had to resort to still hunting and tracking, which was the more difficult. An injury to Mr. McConnell's knee, which made both riding and climbing very painful, forced him to leave for home, and he had to forego the pleasure of this hard, but very interesting, part of the trip. With the difficulty increased by his absence, I had to carry on with the guides. Fortunately, the equinoctial storm broke and brought a light snow. This was ideal, for it made good tracking.

Bright and early the next day we were on our way. Again we noticed cow tracks were scarce, while those of young bulls were quite plentiful. Yet it was plain that they were ranging far and wide. Following these in the possibility that we would have a better chance of seeing cows, we spent another day without success.

On the following morning we spied a single cow lying down, and although she saw us, she lingered long enough for me to bring her down. She was just what we wanted—a yearling—and the one we had anticipated as the most difficult to secure.

On another day we were heading home, having given up hope of seeing anything so late, when across the valley we looked at what we took to be a brown rock. It proved to be a "spike" buck, or young bull, with his first horns still in the soft velvet coat

Continued on page 779

THE SNYDER MOUNTAINS—*An expedition by power boat and airplane to map an uncharted mountain range in Northwest Canada and study the fauna of this unknown region*

By GEORGE G. GOODWIN

Assistant Curator of Mammals, American Museum

THE Snyder Range, which runs parallel to the Mackenzie Mountains in that great unexplored region north of the 60th parallel in extreme western Northwest Territory, has been named in honor of Mr. Harry Snyder's extensive reseach work in this territory. The region visited on this summer's expedition is of special interest from a biological standpoint, as it is somewhere here that we expect to find the missing link in the mutation of Arctic, Hudsonian and Transition species. Owing to the inaccessible nature of the country, practically no scientific research work has been carried on between the Mackenzie and Yukon drainage.

In 1934, Mr. Harry Snyder and I made our first reconnaissance trip by air into this territory and formulated our plans for a study of the region. In 1935, we attempted to scale the white waters of the Nahanni by boat. Our craft was wrecked on its first trial trip in the rapids, but we did get to the Gates, using two 28-foot power scows, and gained our objective at that time—specimens of the white sheep with black tails.

The Snyder Mountain Expedition of 1937 was made possible through the generosity of Mr. Harry Snyder, whose keen interest and unfailing persistence led the expedition through to success.

The Nahanni is a most beautiful but extremely turbulent mountain river, and I heard many weird tales that bordered on the supernatural, of trappers and prospectors who had ventured into this territory and disappeared leaving no trace; others were found dead. One outside story has it that a tribe of hostile Indians resent the intrusion of the white man, but we saw no trace of Indians, though we frequently came across the trail of some lone trapper who spends the winter in this barren wilderness.

Our boats for this trip included a 29-foot clinker-built boat with a 32-horsepower motor, and a sponson canoe with an 8-horsepower motor that was supposed to carry a ton. Arriving at Fort Smith by plane from Edmonton, we found our supplies and engines in the warehouse of the Northern Transportation Company, but the boats had not arrived. After numerous wireless messages, we eventually discovered that they were at Fort McMurray several hundred miles south. Finally we got them to Fort Fitzgerald ready to take across the 16-mile portage to Fort Smith. A 60-mile forest fire spreading across this country was then sweeping over the portage, which, of course, again impeded our progress. A few hours after we left Fort Smith on our way north down the Slave River, the Northern Transportation warehouse, where all our supplies had been stored, went up in flames, and not a single thing in the warehouse could be saved. Had we been delayed a few hours longer the fire would have cancelled our entire trip.

A day and a half on the Slave River brought us to Fort Resolution, but a storm on Great Slave Lake delayed us for two days. A large number of Indians were gathered at Resolution to receive their treaty money. They were dissatisfied with their medical

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GEORGE GOODWIN in conjunction with HARRY SNYDER has told previous episodes of the American Museum's explorations in the Canadian Northwest in "Buffalo Hunt 1935" (NATURAL HISTORY, September, 1935) and "8000 Miles of Northern Wilderness" (NATURAL HISTORY, May, 1936). The reader will also remember other articles of Mr. Goodwin's on bats, on the history of our domestic animals, and on falconry, the latter article being one of the few authentic sources of information on the subject.

Mr. Goodwin's particular interest is in North American mammals, in the study of which he has made expeditions to the West Indies, to various western States, to Quebec, and northwestward in Canada as far as the Yukon. Previously he passed a year in Central Asia and Siberia on the Morden-Graves North Asiatic Expedition which secured specimens of the Siberian tiger and the saiga antelope, a rare animal which few if any white people had previously shot. Mr. Goodwin has been with the American Museum 17 years.—THE EDITOR.

doctor and refused to accept their pay, until he had been replaced by another. The actual grievance against the medico I could not determine; apparently he had not learned the psychology of the Indians. In a way they are like children. I was told, for instance, that an Indian, given a box of aspirin and told to take one each day over a period, prefers to take the whole box at once, to recover the more quickly.

The Indians were having a gala time, however, while waiting for government action. They were playing football and other games, but the main attraction seemed to be similar to our Hide the Thimble, which they accompanied with incessant shouting and beating of caribou hide tambourines. Each team had about 10 men. One side passed a token between them under a long carpet, and the leader of the other side had to guess which man held it. If he guessed wrongly, each man in his team paid forfeits to each man in the other team; if right, the opposing team paid. The tom-toms were used to confuse the captains. They played the game from morning until night, and as there was barely an hour of darkness, this meant they played almost continuously, shouting and drumming all the while. Boxes of matches seemed to be the medium of exchange. Apparently a good time was had by all.

Disquieting stories

While waiting for fair weather, we visited a cabin where four or five trappers were living. They had 40 or 50 sled dogs tied along the lake front, and trapped mainly on the barren lands. Strong, hardy fellows they were; yet when we told them where we were going, they looked at us with a mixture of awe and pity. Did we not know that there was something wrong with that Nahanni? That in the last eleven years, thirteen white men had gone there never to return? "Why, just a little over a year ago, two fellows, well known here in Resolution, went into that country to trap. When they didn't return, a search was made by plane. Their cabin and outside camps had been burned and the men were never found. And take the two McLeod boys: everybody knows what happened to them a few years ago up on the Nahanni. Their bodies were found; they had been shot and mutilated. All these men were thoroughly used to this country and were hard customers. There is a tribe of Indians up there who have decided not to let anyone into their country. Big, strapping Indians they are, too."

Crossing Great Slave Lake, we threaded through the western islands and cruised down the Mackenzie River to Fort Simpson. Here we left the sponson canoe, which had not been built according to our specifications and would have been dangerous in the rapids ahead of us. Instead we hired a boatman, George Roberts, and his pointer scow to transport the excess baggage.

Adversities

While rearranging our supplies on the shore of the Mackenzie, a bank rising fifty feet above the river caved in and buried our outfit several feet deep under soft, sticky mud. On our way the next morning we made good time to Twelve-Mile Island on the Liard, but there the motor on our hired boat failed, and had to be sent back to Fort Simpson. It proved beyond repair, and we proceeded with one of our spare 8-horsepower motors.

The 30 miles of rapids on the Liard were swifter than we had anticipated. We approached them early in the evening and Jim Ross, a tall, typical westerner in charge of the outfit, argued that if he spent the night thinking of those rapids he might not want to tackle them. So we pushed on. Hugging the cliffs and lining the boats where possible over the roughest water, we got over the worst rapids by six the next morning, when Sandy took over the helm and Jim took a much needed rest. That evening we sighted the Nahanni bluff and made the forks by dark.

The Nahanni River, averaging 200 yards in width, flows southeastward through wild country into the Liard. It has an average fall of eight feet to the mile. In places the current rushes fifteen or more miles an hour. The landscape is a jumble of rough mountains, irregular steep ridges, hills, valleys, and ravines.

A supply of 150 gallons of gasoline, which we had expected to find at Fort Simpson, was supposed to be awaiting us at the forks in care of a trading-post. There was only one person here, a woman, who was in charge. Her husband had been in Edmonton for several months. Although our wireless showed that arrangements had been made with her husband to supply us with gas, she politely but firmly refused to give us any, stating that the wire was not from her husband. After considerable argument, however, and paying $2 per gallon in cash, she agreed to let us have it and we were able to proceed. We made relatively good time, as the days were long. Twice we were almost capsized when we struck submerged rocks in midstream. These rocks always seemed to be placed in the middle of the roughest water on the swiftest rapids.

The second day we arrived at the so-called Tropical Valley or Hot Springs, an area of not more than two miles radius of flat, muddy soil more or less covered with a thick undergrowth, with small grassy meadows. Hot Springs bubbled up about a

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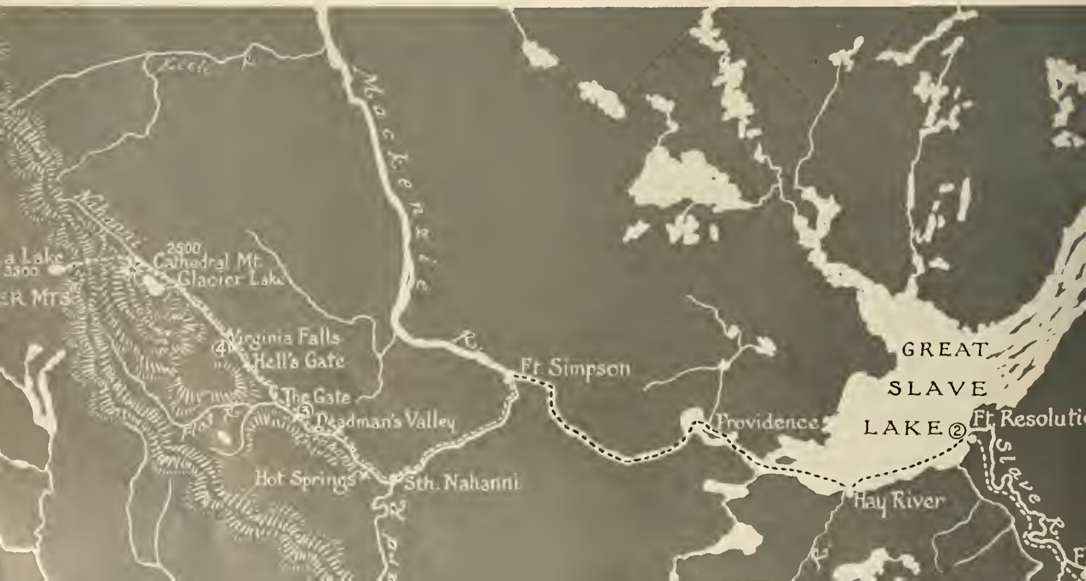
1. *(Left)* Wood buffalo south of Great Slave Lake in northwestern Canada, the first section visited by the Snyder Mountain Expedition of 1937. This was the third extensive expedition sponsored and organized by Mr. Harry Snyder accompanied by Mr. George G. Goodwin of the American Museum staff for the systematic study of the Mackenzie River District and the Yukon Territory

2. *(Above left)* Great Slave Lake: a subarctic expanse of water larger than Lake Erie on which the expedition was halted for two days by storm on the way to the Falls of the Nahanni and the Snyder Mountains

(Above) Indians of Great Slave Lake celebrating their annual gathering at Fort Resolution for the collection of their treaty money. Various games were played amid incessant shouting and beating of caribou hide tambourines

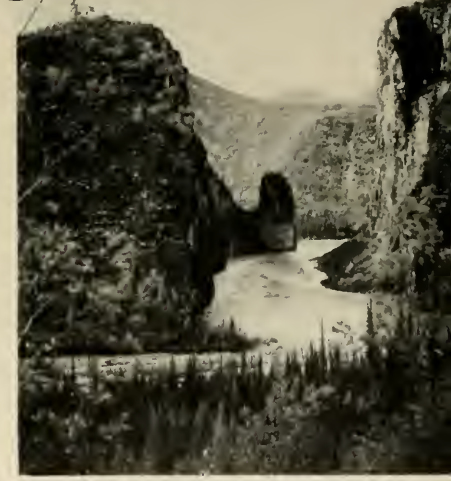

Keele R.
Mackenzie R.
Nahanni
a Lake
3500
ER MTS
2500
Cathedral Mt.
Glacier Lake
④ Virginia Falls
Hell's Gate
The Gate
③ Deadman's Valley
Flat R.
Hot Springs
Sth. Nahanni
Ft. Simpson
Providence
GREAT SLAVE LAKE
②
Ft. Resoluti
Slave R.
Hay River

③

3. *(Above)* Camp at The Gates of the Nahanni which the expedition reached after navigating the rapids of this dangerous and rarely traveled river

(Above right) George G. Goodwin, Museum mammalogist, at work on specimens in his outdoor laboratory at The Gates; at left, Sandy Macnab, center, George Roberts

(Right) One of Nature's wonders: where vertical walls of rock rise more than 800 feet to form The Gates through which the turbulent Nahanni rushes at 15 miles an hour or more



4. *(Below)* Virginia Falls, a spectacular plunge approximately twice as high as Niagara. Few white men have laid eyes on these falls which lie over 200 miles from the Mackenzie River in an inaccessible section of Northwest Territory

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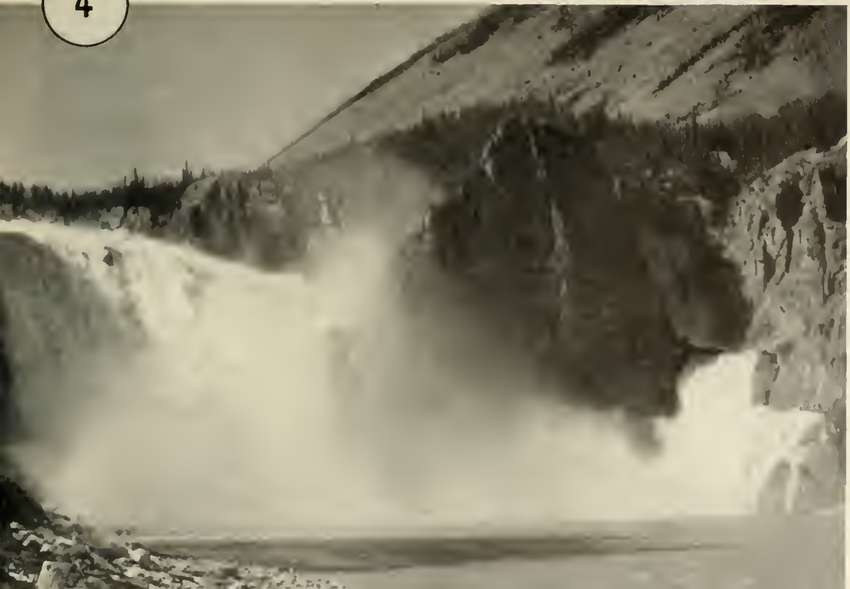


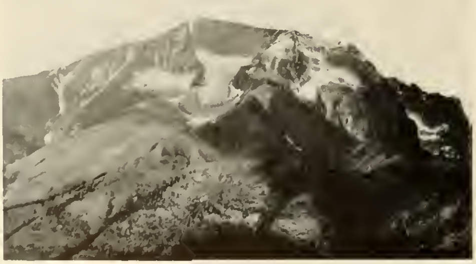
(Above) THE BRINK of Virginia Falls where the melted snows of the Snyder Mountains thunder 300 feet through space en route to the Mackenzie River and the Arctic Sea

(Above) THE VEIL OF MIST drifts aside only momentarily to reveal a spectacle of indescribable beauty. By a difficult portage the expedition surmounted the falls

(Above) GLACIER LAKE in the Snyder Mountains where the party, assisted by airplane, carried on their major scientific activities

(Above) MR. HARRY SNYDER inspects a raft for measuring the lake's depth. Ground parties collected extensive specimens of the animal life

(Below) A HANGING GLACIER protrudes its massive tongue over the lip of the bowl it carved in ages past



(Above) Two members of the Expedition at the camp on Glacier Lake where bears were frequent vistors: Harry Snyder and Fred Lambart planning new geological trips after a hard hunting excursion in the Snyder Mountains

(Below) H. F. Lambart of the Canadian Geodetic Survey who directed the work of charting the Snyder Mountains taking infra-red pictures from a summit

Karl E. Stein, assistant surveyer, beside a cairn used in the mapping activities. Bad weather necessitated 24-hour duty on instrumental work at times

(Above) REFUELING AT McMURRAY: one of the planes by which part of the personnel of the expedition returned to Edmonton

SIXTEEN POUND TROUT from Glacier Lake's depths were caught by Col. A. J. (Sandy) Macnab, to replenish the camp's larder. "Sport," Sandy's English setter, gave evidence in his own canine way that he enjoyed the trip throughout

(Below) AN AERIAL VIEW of the crags and summits which divide the drainage of the Yukon and Mackenzie Rivers: a section of subarctic Canada whose animal life offers a link in the mutation of Arctic, Hudsonian and Transition species

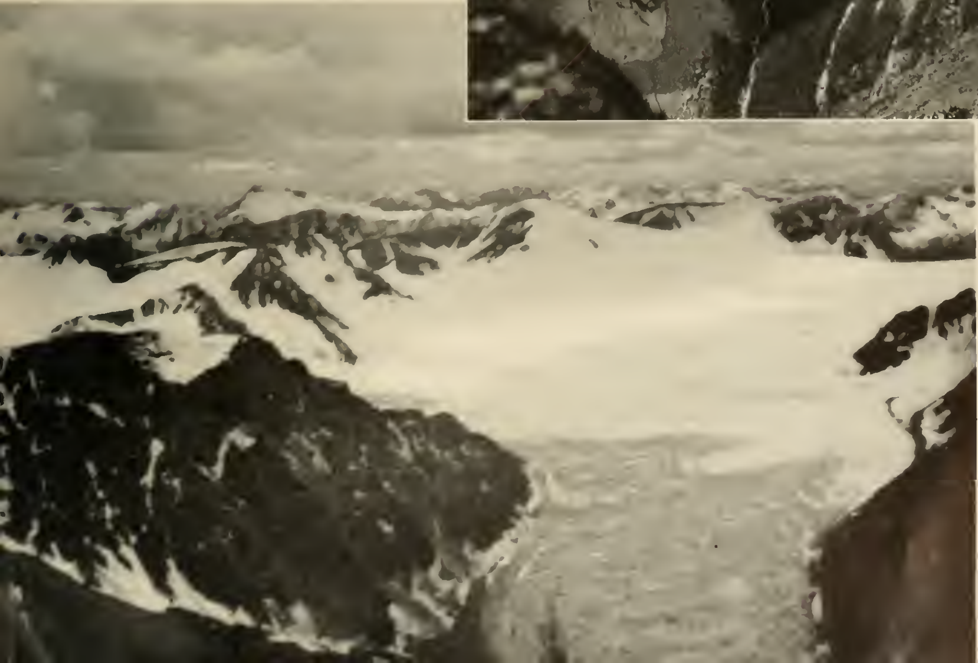
(Below) A RAZOR-EDGED PEAK which human feet have never trod and human eye but rarely seen: a typical aerial vista in the significant biological zone which the Snyder Mountain Expedition of 1937 explored

(*Above*) THE HIGH RIDGES OF THE SNYDER RANGE extend in seemingly endless succession. The razor-edged ridges average about 6000 feet, the highest peaks about 10,000

(*Above*) THE CRAGS AND PINNACLES of these newly discovered mountains suggest in some places the colorful Dolomites of the Austrian Tyrol

(*Right*) SHEER CLIFFS and deep valleys give the Snyder Mountains a splendor rarely equalled in mountains of their height

(*Below*) A VAST HITHERTO UNRECORDED ice field was discovered ten miles above the head of Glacier Lake. Frequent rock avalanches gave evidence of Nature's slow but mighty sculpturing



quarter of a mile from the river bank, with a temperature of about 95° F. The animal life in this strange environment, however, proved no different than elsewhere. One weasel taken was pure white, but it was an albinistic individual. Mice, voles, shrews, squirrels, and other small mammals were normal.

With engines racing full speed, we crawled out of the first canyon and camped on a sandy level above the river. Strangely enough we found two paddles here, one a new custom-built paddle, the other a home-made affair. There were also signs of a recent camp here. Indians would hardly leave their paddles, yet as far as we could learn, no one had been in this vicinity for some time.

Entering Dead Man's Valley, we jogged along with relative ease, and stopped at noon near the beginning of the second canyon, not far from where the McLeod boys were buried. The valley looked very calm and peaceful, probably much as it appeared to the McLeod boys until they were murdered. The fourth day we camped at the Gates, one of Nature's wonders. The walls of the canyon rise straight up for 800 feet and the river rushes through. The following morning we passed the Rapids of the Drowned, so named because a party of Indians lost their lives at this point.

Swift water

All went well until we reached Hell's Gate, where the shaft on the 32-horsepower motor snapped. Strange as it may seem, this occurred in relatively deep water and was not caused by striking rock. From here we had to make relay trips with the small pointer scow to the falls. At Hell's Gate, the river makes a sharp right angle turn between sheer cliffs and the rapids dash headlong into the face of a rocky wall. Everyone who knew the river advised us not to try to run a loaded boat through Hell's Gate, but our boatman thought he could make it. Entering the rapids from the side, a surging, boiling current lifted the stern of the boat clear of the water. With motors roaring and having no control, the boat was dashed against the cliff. The board holding the engines was ripped off and they went overboard. Fortunately, the current carried us into a backwater above the crest of the torrent; and the motors, attached by safety ropes, were pulled ashore.

We patched up the boat with spruce pitch and were soon humming onward, none the worse except for a good scare. The scow, however, leaked badly and the extra pressure of the swifter water made it extremely unsafe. In fact, the boatman expressed his opinion that the last relay he made was about all the boat would stand. Some of the party preferred to walk the remainder of the way over the rocky mountain ridges rather than attempt the hazardous trip by water. The last three miles of the rapids were probably the roughest and most turbulent section of the river.

A spectacular waterfall

Rounding a sharp turn, we came into full view of Virginia Falls. The splendor and beauty of this ponderous volume of water, as it roars over a precipice and thunders 300 feet to the river below, are indescribable, and we gazed spellbound at the glory of it all. The falls, together with the rapids above them, make a descent of 390 feet. Right at the brink a huge column of rock divides the falls into two sections. The water drops into a many-colored, rock-walled canyon, and rushes on down and around a bend. Perched high on a rocky crag facing the falls, is the eyrie of a golden eagle. The falls, like most illusive things of the North, are moody and retiring; shrouded for the most part in a veil of white mist, they break out into the bright sunshine in all their splendor and beauty. The fog is swept aside, but only to creep back and draw the veil once more, throwing a perfect rainbow across the canyon.

The portage of one mile around the falls was very steep and difficult. The first section was 100 feet up a small stream trickling over loose rocks, then through a marsh, over a dry hilltop 470 feet above the river and down to the bank.

The next noon Mr. Stanley McMillan, of the Mackenize Air Service, arrived in the Fairchild plane to fly us to Glacier Lake in our main collecting area in the Snyder Mountains. On the first trip went Colonel A. J. ("Sandy") Macnab, whose unfaltering rifle was responsible for most of the big game trophies secured by the expedition, Joe Callao, our cheerful Indian guide and tracker, and I. We had to take off down-wind. Up-wind would have brought us directly over the falls and the down-draft here was too dangerous to attempt without a landing below. Down-wind, however, proved nearly as hazardous. Clearing the water and rounding a bend in the river, we struck a down-draft, which tipped the plane until one wing almost skimmed the surface of the water. Only the quick action of the pilot saved us: always ready for emergency, he righted the plane with the stabilizer. An hour and a half in the air brought us to our destination, and we made base camp at the upper end of Glacier Lake. The plane returned to Fort Simpson to bring in a supply of gas for a reconnaissance of the region by air, and a possible trip to nearby Summit Lake.

Glacier Lake, situated in the heart of the Snyder Range, is one of the most beautiful places in the North country. Its mirror surface and perfect silence, broken only by the cry of a loon, were a great contrast to the thundering falls. A white granite peak overshadows the upper end of the lake, its perpendicular walls towering 4000 feet. Next to this is a red mountain apparently saturated with iron. Springs spouting from its sides have stained the slopes with rust. Timber climbs 2000 feet up the mountain slopes. On the high ridges light snow fell frequently throughout the summer. The lake itself is 2500 feet above sea level, five miles long and about a half a mile wide, and has a measured depth of 175 feet. It contains plenty of fish, both lake trout and grayling. Some of the large trout landed tipped the scales at 16 pounds, and made a welcome addition to our larder.

The Snyder Range is a regular mountain paradise. From Glacier Lake high mountain ridges extend as far as the eye can see in seemingly endless succession. Peak beyond peak, towering chimneys and vast ice-fields came into view as we scaled the mountain slopes. The numerous peaks more or less joined by narrow, razor-edged ridges average about 6000 feet, and the highest are probably not more than 10,000 feet.

Mr. H. F. Lambart, of the Canadian Geodetic Survey, and his assistant, Mr. Karl Stein, of New York, settled down to the difficult task of charting the mountains and putting them on the map. It proved considerably more of an undertaking to scale some of the peaks than appeared from the lake, for distances were most deceptive.

Loose rocks at the base of the granite pinnacle on the upper end of the lake, which seemed from camp to be about three feet in diameter, proved to be as big as churches. A base line was cut one mile long on the shore of the lake, carefully measured and posted. Observation stations were established on the surrounding mountain peaks. Almost continuously overcast sky delayed triangulation, and clear days, when we got them, necessitated 24-hour duty on instrument work. One of the flag-pole markers established a mile down the lake was continually being pushed down and we never did find the reason for this. Some ten miles above the head of the lake a glacier creeps down the mountainside, and beyond we discovered a vast hitherto unrecorded ice-field. Avalanches of rock and landslides were quite frequent around the lake. One afternoon in particular there was a continuous rumble in the mountains that lasted for a considerable length of time. Scanning the ridges across the lake, I saw a river of rock pouring steadily down a gulch, ploughing its way through the timber and down across a meadow to the creek above the lake. It was literally a river of rock, keeping within certain bounds, pouring from a seemingly inexhaustible source.

The first clear morning we started on our reconnoiter trip by air. Rising in great spiral circles, the plane rose above the mountain ridges and crossed over to the valley of the Nahanni. We followed its course for about fifty miles, then turned west and skirted along the border of the Snyder Range, and were amazed at the extent of the ice-fields. Summit Lake proved to be too small and shallow for a landing and we continued on for about fifty miles, where we found a good-sized uncharted lake, and the pilot made a splendid landing. This lake proved to be 3500 feet above sea level, surrounded by rolling mountains. Five days were spent here and a good representation of the fauna was secured. At the time we landed, three mountain goats were on a ridge to the north of the lake. Here Harry Snyder shot a moose and a grizzly bear. The grizzly ran head-on for Harry as he was scaling the ridges some miles back of camp. Jim was carrying his gun at the time, and Harry yelled to him, "Shoot that grizzly." The bear was about 30 feet from Harry and he was 30 feet from Jim. Jim did not see the bear, as it never occurred to him that it might be so close. Harry hurried toward Jim and in what must have seemed an eternity got to him and opened fire.

There were signs of caribou but we did not see any animals. There was splendid fishing in the lake and Sandy Macnab kept us well supplied with fair-sized grayling and trout.

Returning to Glacier Lake, the pilot increased the altitude and we flew over the ice-fields and got some good pictures. The grandeur and beauty of these mountains cannot be exaggerated. Clouds were rapidly closing in and by the time we landed, all the peaks were shrouded in fleecy white clouds. Running a trap-line at the upper end of the lake, I found fresh tracks of bear that headed straight for camp. Ted Boynton, the cook, said he had not seen any sign of bear while we were away, but on inspecting the meat cache we found it had been torn apart and all the meat was gone. The following evening, as we anticipated, the bear again visited our cache.

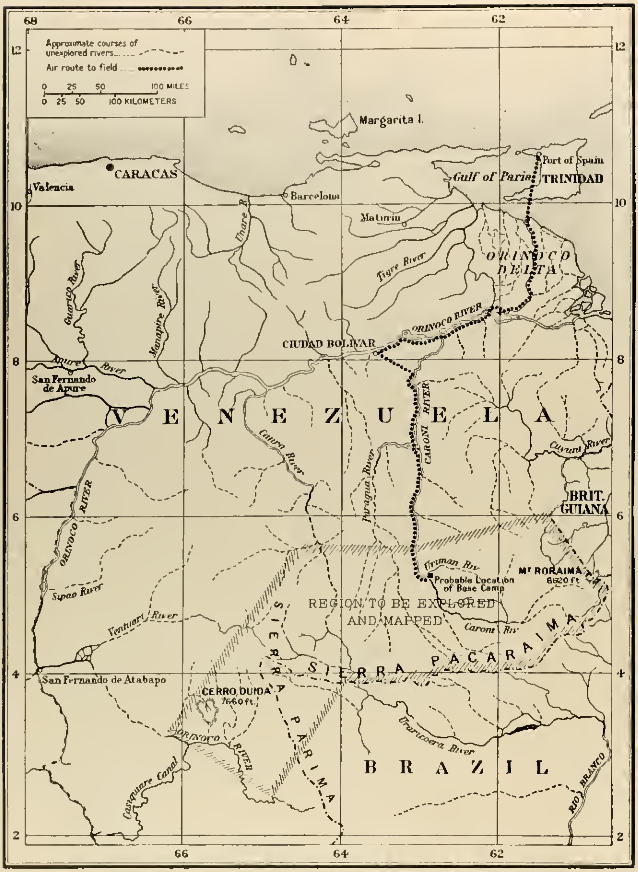
A careful survey of the mountain slopes around the lake revealed two big billy goats on the high crags some 5000 feet above the lake. Looking them over with a 24-inch monoscope, they appeared to be very big fellows, but as they were barely through shedding their hair it seemed advisable to leave them for a while.

Sandy and Jim made a trip up a canyon from

Continued on page 780

The Phelps

A new "Lost World" is found on an isolated tableland in the least known section of South America



Approximate courses of unexplored rivers
Air route to field
0 25 50 100 MILES
0 25 50 100 KILOMETERS
68
66
64
62
12
10
8
6
4
2
Margarita I.
Port of Spain
TRINIDAD
Gulf of Paria
CARACAS
Valencia
Barcelona
Maturin
Unare R.
Tigre River
ORINOCO DELTA
ORINOCO RIVER
CIUDAD BOLIVAR
Guarico River
Manapire River
Apure River
San Fernando de Apure
V E N E Z U E L A
Caura River
CARONI RIVER
Paragua River
Cuyuni River
BRIT. GUIANA
ORINOCO RIVER
Icaman Riv.
Probable Location of Base Camp
Mt RORAIMA 8620 ft
REGION TO BE EXPLORED AND MAPPED
Caroni Riv.
Sipao River
Ventuari River
P A C A R A I M A
S I E R R A
San Fernando de Atabapo
CERRO DUIDA 7660 ft.
ORINOCO RIVER
S I E R R A P A R I M A
Uraricoera River
B R A Z I L
Casiquiare Canal
RIO BRANCO

The dotted line on this map was drawn in 1931 as a proposed route to an unknown section of Venezuela. Where it ends it was thought there might be a mountainous "isolation zone" similar to Mt. Roraima and Mt. Duida previously explored. Recent aerial exploration reveals the existence of just such a tableland on almost the exact spot proposed several years ago as a base camp

The expedition, which is now en route to Mt. Auyantepuy, Venezuela, promises to form a fitting climax to our memorable and successful explorations of Mt. Roraima and Mt. Duida.

Mt. Roraima lies at the junction of Venezuela, British Guiana and Brazil. It has a table-top about 25 square miles in extent, precipitous sides and an average elevation of about 8500 feet. Many new species of plants and birds have been described from Mt. Roraima and the commonly held belief that they were confined chiefly to its almost inaccessible top gave to the mountain a romantic distinction. Many people will recognize it as the original of Conan Doyle's "Lost World."

Mt. Duida is situated on the upper Orinoco, about 400 miles from Mt. Roraima. In July, 1928, G. H. H. Tate accompanied by Mr. Sidney F. Tyler, Jr., who financed the undertaking, led a Museum expedition to explore this mountain. At this time both the mountain and its life were wholly unknown and when Tyler and Tate ascended it they were not only the first naturalists, but probably the first human beings, to behold the basin-like tableland of approximately 250 square miles that at an average altitude of 4500 feet form its summit. They had indeed discovered a new world.

The success attending the expeditions to these two interesting mountains and the discovery of the before unexpected faunal relationships of Roraima and Duida, aroused a strong desire to explore the region lying between these two mountains. It was our belief that we would find there other mountains, remains of the great tableland that once covered this region. In which event they would be inhabited by species related to those we had already found on Roraima and Duida.

But it was not without reason that this territory still remained the least known part of South America. On the north it was protected by trackless forest and unnavigable streams; on the south by vast areas of still unexplored territory in Brazil. By airplane alone could we hope to penetrate it. But although this was not more than seven years ago, exploration by airplane had not yet reached a stage where one could enter a region lacking sufficiently large bodies of water to assure alighting places.

An attractive prospectus, illustrated with maps and photographs, of a proposed expedition into the unknown region was issued, but it failed to arouse sufficient support to enable us to carry out our plans and for the time they were reluctantly abandoned.

Meanwhile, the growth of Venezuela's oil industry and the development of the airplane as a dependable transport over unknown regions greatly increased our knowledge of before unvisited parts of South America. That portion of Venezuela in which we were interested could now be reached from the Orinoco in two hours instead of two months, if at all. Hence it happened that a prospector by air in this region discovered an uncharted mountain estimated to be twenty miles long and not less than 8000 feet high.

Knowledge of this discovery reached William H. Phelps of Caracas. Long a student of birds and a friend of the Museum he realized its significance and wrote us a leter such as curators may dream of but few have ever received. In brief he described the general character of the new-found mountain in sufficient detail to indicate that it was a large scale Roraima and added an offer to sponsor a Museum expedition to explore it

Venezuela Expedition

provided due permission was given by the Venezeula Government.

If, under the influence of special inspiration, I had written a letter to myself I could not have produced one which would have been received with greater enthusiasm. The prospectus of the abandoned expedition was reëxamined and it was found that the newly discovered Mt. Auyantepuy is almost exactly on the site of our "proposed camp" (see map). Here, indeed, was a tribute to the accuracy of our prognostications!

The significance of the Phelps Venezuela Expedition must be considered in the light of the previous discoveries made on the two other mountains. The American Museum expedition to Mt. Roraima in July, 1927, which was led by G. H. H. Tate, assisted by T. D. Carter, under the auspices of Mr. Lee Garnett Day, secured collections which gave us a far truer picture of the mountain's life than had existed before. The summit is devoid of forest and only two species of birds were found there. One, MacConnell's Sparrow (*Zonotrichia brachyspiza macconelli*), is represented by a close ally at a distance of only 1400 feet in the growth on the talus which surrounds the mountain. While the two forms are prevented from meeting by the sheer cliff that separates their homes, it is the difference between the climate of their respective haunts that more effectively keeps them apart. The race from the top of the mountain, reflecting the colder, moister nature of its habitat, is larger and darker than the race that occupies the warmer, less humid area below. Here, indeed, is a convincing demonstration of the development of an upper zonal form from an ancestor still existing in the immediately preceding zone.

Unlike Roraima, the summit of Duida proved to be forested. Many new plants and birds were collected there but, so far as the latter are concerned, the fauna of Duida proved to be closely related to that of Roraima. The facts are presented in an article on the birds of both mountains in the American Museum Bulletin for 1931 (Vol. LXIII, pp. 1-135). They are summarized in the following statement:

Common to both mountains, as identical forms	34
Common to both mountains, as representative forms	28
Found on Roraima only	17
Found on Duida only	7
Total	86

The greatest interest is attached to the prospect of further discoveries which may be made on the isolated summit of the third, intermediate mountain.

The five months that have elapsed since this mountain became our objective have been fully occupied in preparations. Fortunately, Mr. Tate (who meanwhile has become Doctor Tate) returned from his work with Mr. Archbold in New Guinea in time to take the leadership of this new expedition. With ascents of both Roraima and Duida, and incidentally Turumiquire in northeastern Venezuela, to his credit Tate is especially qualified to direct this undertaking. He will have as his assistants Mr. W. F. Coultas, for years in charge of the Whitney Expedition in the Pacific, E. Thomas Gilliard, and James A. Dillon of the Museum staff. Mr. Phelps, who has recently renewed his interest in ornithology, will also join the expedition.

The expedition assembles at Ciudad Bolivar, on the Orinoco November 27 and thence, as soon as may be, takes flight for Auyantepuy.

FRANK M. CHAPMAN
Curator of Birds,
American Museum

BARRIER CLIFFS of Mt. Roraima, the probable original of Conan Doyle's "Lost World": a biologically isolated zone, which may be duplicated on the newly discovered Mt. Auyantepuy

A BOAT IN BIMINI—*Through a "home-made" glass-bottomed skiff the Lerner Expedition explores the "living rainbow" that swims in Bimini's shallows, as preparation for a glass-floor exhibit in the Hall of Fishes*

By FRANCESCA LAMONTE
Associate Curator of Fishes, American Museum of Natural History

WE had gone to Bimini to study the Blue Marlin, so plentiful in those waters and so hard to transport intact to the Museum laboratories because of its enormous size.

Michael and Helen Lerner were there ahead of us with three cabin cruisers equipped to catch these big fishes for us on rod and reel, the only way they are caught off Bimini. But after we got there, an old glass-bottomed water bucket nailed to a pole suddenly diverted our attention from the marlin for a few moments one morning, and thereby gave the Lerner-Bimini Expedition its two-fold purpose—the Blue Marlin and the Glass-Bottomed Boat Group.

The fishermen in Bimini usually come back to the island for the three hottest hours of the day, from twelve to three, bringing their morning catches with them. Those hours were when we did our first period of work on the marlin; the other period was from five o'clock on, when the boats began to come in again. In such a hot climate it is next to impossible to keep large specimens like the marlin for any length of time, so we were constantly in need of fresh material, and for the same reason it was necessary to use it as soon as it came to the docks.

In between these sessions with the marlin, we did our collecting of smaller fishes.

Bimini waters are calm, turquoise in the shallows and cobalt beyond in the Gulf Stream, and very clear. Looking into them, one gets a tantalizing hint of the living rainbow that swims below. Some of these vivid little fishes vary greatly both in color and shape depending upon the particular niche of the ocean in which they live; whether it is around a dock; on a sand bottom; in a conch shell; or among the mysterious caves and arches of a coral reef. To observe them in their proper background is the reason why people walk around the ocean's floor in a diving helmet, now part of every tropical expedition's equipment, or go down to the great depths in bathyspheres.

But there is still another way of observing fishes in their home haunts, particularly in fairly shallow, calm water.

On one of our trips, we had been hand-lining for some time, trying for the bright little Beau Gregorys, among whom there is an amazing variation of color that may be connected with their habitat. But the brilliant little blue and golden creatures evaded our hooks and we brought up only the usual collection of grunts, squirrel fish and queen triggers.

We had climbed back from the skiff to the cruiser for consultation about different hooks and bait, or the wisdom of trying nets, when the humble glass-bottom water bucket suddenly appeared from some obscure part of the boat, was lowered into the water, and someone said "Look down there."

We looked, and caught our first real sight of Bimini's undersea world. From then on, it was just a question of who could get his head over the small bucket by main force or by pointed reminders about good manners.

I don't know who first said "glass-bottomed boat" but Michael Lerner characteristically went into effective action, and two hours later the skiff from his own cottage, The Anchorage, was on shore with two men hammering and sawing at it.

It was a very light, very hot morning two days later, and very calm on the water that I could see from my windows. There had been chattering negro

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FRANCESCA LAMONTE has from childhood lived in many countries; and in latter years she had studied the fish of many waters. Her work in Bimini was a logical sequel to her swordfish research last year in Nova Scotia as a member of the Lerner Cape Breton Expedition. Aside from numerous scientific papers, she has written extensively in a popular vein. She is interested in a good fish story for she has charge of the official world record game fish charts.—THE EDITOR.

voices on the King's Highway for an hour or so, so I knew it was around four or five in the morning. Across the hall I could hear Miles vigorously working a flit gun; and Ludy, our artist, had gone up the walk to the laboratory fully an hour before. I felt guilty to think of him hard at work, but I did not feel inclined to move. The lure of breakfast in the heat of a Bimini dawn in July is non-existent.

Then someone stuck his head through the window with the loose screen and said, "Your boat will be ready this morning."

FLORIDA
BIMINI
BAHAMA ISLANDS
ATLANTIC OCEAN
CUBA
CARIBBEAN SEA
D.F. Levett Bradley

That brought me out of bed at once. Right outside our cottage windows, upside-down across sawhorses lay the Anchorage skiff, but from that day on, this boat stepped out of the rank and file of Bimini skiffs and became "the glass-bottomed boat."

To be completely professional, the bottom of a glass-bottomed boat should be made of quartz, and over this observation window there should be an awning or some protection from the sun and from reflections. But the pilot boat only stops at the tiny island of Bimini once a week, and orders to the mainland often get back to Miami by way of Nassau some one hundred and ten miles the other side of Bimini! So we made our boat out of what we had on the island.

A space about three feet square was cut out of the bottom planking and a pane of ordinary window glass fixed in it. Around the pane we erected a fence of solid boards. This was as high as the boat and was put up so that if we fell through the glass in our enthusiasm, the entering water would not sink the boat, for both ends of the boat would stay afloat.

That was the whole operation and our glass-bottomed boat was complete. We towed it out behind a cabin cruiser, Michael Lerner and one of the boys sitting in it waiting to find some view that looked particularly interesting. Then it was released from the tow rope and four of us crowded around the fence of the window, the good-natured Tommy Gifford poling.

An ever-changing scene

There never was a noisier crowd. We were so very much pleased with our home-made boat. Every fish that swam into view was loudly hailed and its description shouted back to the people still on the cruiser. Everything got its full share of publicity from the most ordinary yellowtail, dozens of which we had been hand-lining, to the brilliant and enormous blue-green parrot fish that suddenly swept across below us. Our gesticulations nearly sent us to join the ranks of undersea life. There were constant loud admonitions of "Look out for the glass!" "Move over!" "Get your head out of the way!" "Don't move, anyone, I want to try a picture!"

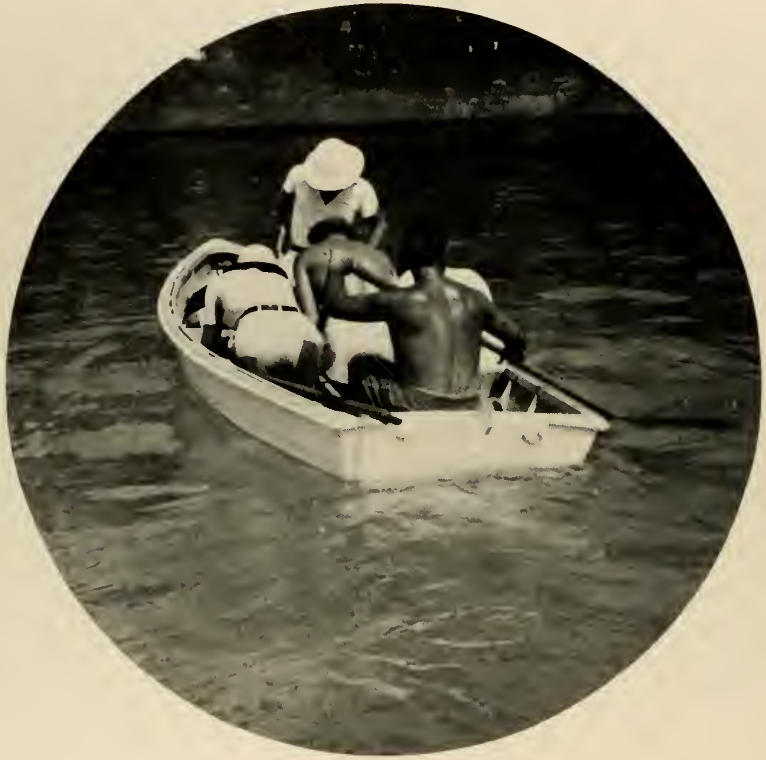
Four heads crowded under a tarpaulin above the glass pane, while two pairs of hands tried to work cameras. Our pictures, I am sorry to say, were failures. Not quite complete failures, for to our own eyes the prints suggest the view we saw, but looked at impartially I must admit that they show practically nothing but the ripples in the glass.

No photograph or painting, however, could possibly reproduce that sight. We watched for hours under the blistering Bimini sun, regardless of the heat or of our cramped positions in the skiff. Below us, in and out of the grey, yellow and maroon corals, down into the sudden, deep, white-floored wells, in and out among yellow and magenta sea-fans, swam silent hordes of fishes. Queen triggers with bright powder-blue bars, blue parrots, black and yellow butterflies, black fishes, scarlet fishes, purple and

A Window to the Sea

(Below) THE "HOMEMADE" GLASS-BOTTOMED SKIFF which enabled the Lerner Bimini Expedition to make observations and collect material for a glass-floor exhibit in the American Museum's Hall of Fishes. This novel exhibit mounted beneath the floor will give the illusion of peering through a window at the kaleidoscopic marine life of Bimini's shallows

H. Doty photo

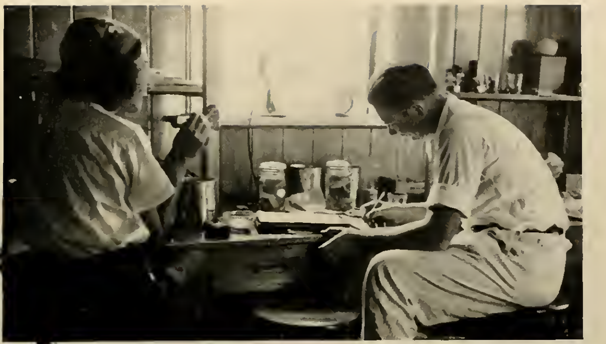


(Below) BIMINI FROM THE AIR: a small strip of land lying 70 miles west of Florida in a shallow sea whose abundant fishes make it a favorite haunt for anglers

G. M. Conrad photo

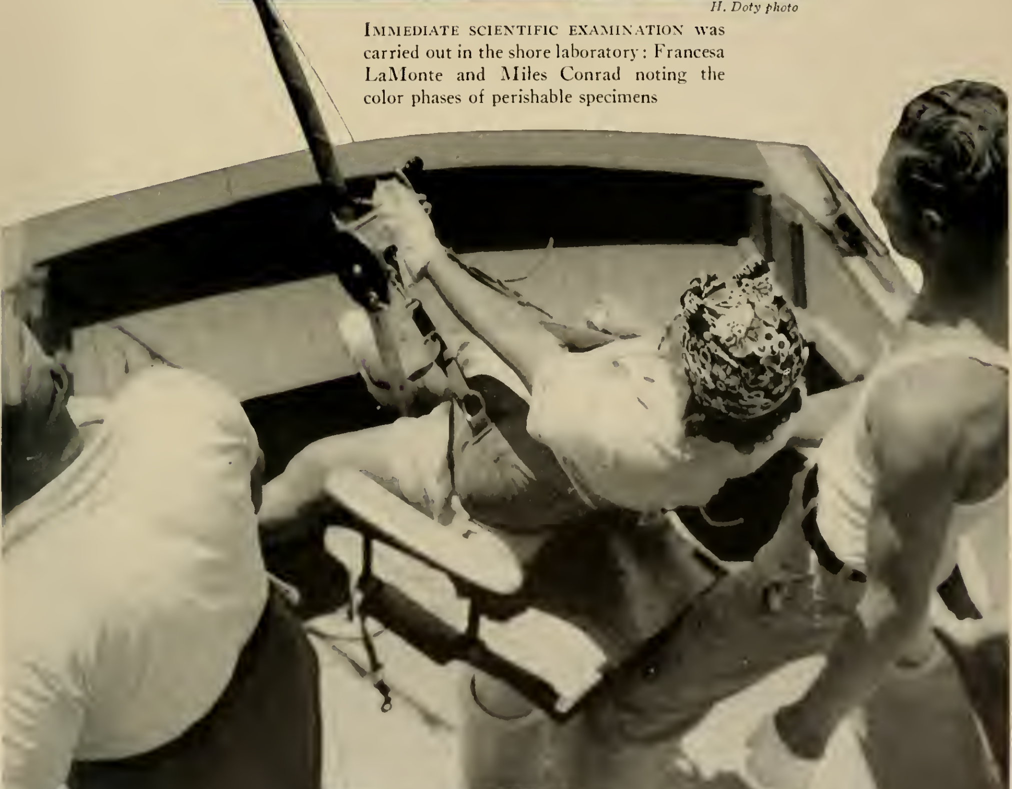
(Below) THE WRECK: a battered derelict grounded near the island in whose shadows many of the studies were made. Soft clumps of sea bushes wave over the glistening white sand, against which the brilliant forms of variegated fishes play in a veritable living rainbow

H. Doty photo



H. Doty photo

IMMEDIATE SCIENTIFIC EXAMINATION was carried out in the shore laboratory: Francesa LaMonte and Miles Conrad noting the color phases of perishable specimens



H. Doty photo

(Above) MRS. LERNER brings in a blue marlin, one of the specimens on which intensive scientific study was made in the tent laboratory

(Left) THE COTTAGE occupied by members of the Lerner Bimini Expedition during their work for the glass-floor exhibit and on the blue marlin

L. Ferraglio photo

yellow fishes, blue fishes with green heads or shining silvery spots; an enormous crayfish half out of a crevice; schools of grunts, a shark, a barracuda, a horrid dark little fish who darted around nipping his acquaintances. And the ray. For an hour or so I had been keeping to myself a growing suspicion about the extraordinary size of certain species below us well-known to me from preserved specimens. Then we saw the ray. It was huge and spread flat on the bottom, partly covered with the white coral sand. One of the men suggested harpooning it and bringing it up. In poling the boat into position for the harpoon, the oar went under the glass for a moment and my suspicions grew. It looked very peculiar, but I had not noticed it particularly before and said to myself, "Maybe Bimini oars are different." Then the harpooner got his prey. Triumphantly he brought the ray to the top, and we saw it. My suspicions were most amply confirmed. It was a very miserable little ray indeed. Our glass magnified.

Probably the right kind of quartz does not do this, but it was of no special disadvantage and even of some advantage in observing the smaller specimens.

We spent a lot of time poling in among the débris and twisted steel under the Wreck, a battered derelict grounded near the island, where we chummed* and then watched the fishes as they came up to snatch the food. To me, the most fascinating of all views were the quiet patches of white sand thirty or forty feet down. Over everything through those waters is a light green wash, impossible to reproduce in painting because it is perfectly transparent, as if one were looking through glass faintly tinted green. On that white, white sand grow softly waving clumps of dark green and brown sea bushes. The intense pink of a half-buried conch shell shines in one corner, and everywhere swim busy little yellow and violet fishes.

A glass-floor exhibit

This is what we plan to show in our Glass-Bottomed Boat Group in the Hall of Fishes of the World. We plan to sink the group below the floor level, and to fence in the covering glass pane as our original window to the sea was fenced off in the boat. The visitor, looking down, will see below him the end of a coral reef with its reddish-brown fingers and perhaps a waving yellow sea-fan, then the white floor of the sea, the blush-pink of conch shell, a soft green sea bush, and, swimming past, the deep glowing blue of a *Stegastes,* the lithe green body of a blue-head, a translucent rosy *Apogon,* or perhaps a silvery butterfly fish. The group will be a small one, and will only include the vividly beautiful little fishes that are so often overshadowed by their larger relatives.

Simple tackle

Of most of these fishes we managed to get actual specimens although one or two of them, especially a gleaming blue and silver fish, eluded all hooks, traps and nets. Butterfly and surgeon fishes, queen triggers and blue-heads are easy to bring up on any kind of hook. We caught them on rod and reel, and on a hand-line off the dock. One really needs no equipment to have a lot of fun fishing in a place like Bimini. Our very best dock hand-line was made of a ruler, a piece of ordinary cord, and a small hook borrowed from a very black child who had been catching his luncheon off the dock. You can usually find an old piece of conch lying around to use as bait. Or you can do without hook and line at all. If you dive off the dock and bring up conch shells from the bottom, you will frequently find in one of them one or two good specimens of the small, bright fishes that frequent these shells.

Traps get larger prey, such as parrots, the ever-present grunt, triggers and angel fishes, or squirrel fishes with their brilliant red and silver stripes, and an occasional scarlet goatfish. Nets catch the smaller species, especially in the Gulf Stream where a netful of gulfweed brings in with it little finger-finned frogfishes and small silvery Carangids. Bimini is a fine collecting spot because you can gather your specimens so easily and within such a short distance of the laboratory. You can take a pail of fishes; examine them living before their colors fade or change as all fish colors do, and then throw back those you do not need, still alive. The small hooks we used did not seem to trouble the fish either, and they would swim right off again when released; sometimes, in fact, before we landed them.

The latest issue of the Bimini Bugle, a four by five inch newspaper published by the natives, speaks of "a glass-bottomed boat" as one of Bimini's attractions. This may be our skiff, but there is no reason why the number should be limited to one. Anyone who has a rowboat, a hammer, a saw and a piece of glass can make a glass-bottomed boat, and off an island like Bimini, where the water is shallow for the most part, you can amuse yourself for hours just rowing around until the view looks interesting, then sitting there on the calm water and looking through your window into another world.

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*The fisherman's term for scattering oily fish as bait.

YOUR NEW BOOKS

RACE: OUR MODERN SUPERSTITION • EARLY AFRICAN FOLK LORE GRASSROOT JUNGLES • HOW TO HUNT FOSSILS • VAN LOON'S GUIDE TO THE ARTS • EDDINGTON ON EINSTEIN

RACE: A study in modern superstition

- - - - - - - - by Jacques Barzun

Harcourt, Brace and Co., $2.50

THEY burned witches in Salem. The reason why was all perfectly clear to erudite Cotton Mather as well as to plain John Brown. For no obvious reason accidents befell the cattle, crops were blighted, farmers and their goodies sickened and often died. Surely, then, the witches who, everyone knew, consorted with evil spirits and were endowed with malignant powers must be responsible for these unnatural events. The result: poor, harmless and defenseless women, often old and a little doddering, were destroyed. This, we may feel, was an ancient folly, impossible in our enlightened, civilized society. On the contrary, says Mr. Barzun, the present race madness is of a piece with this antiquated superstition. We have substituted another set of devils, but we employ equally stupid and irrational thinking. And he proceeds to expose in relentless fashion the illogic and the cruelty of the current applications of the race concept.

The idea of race has permeated almost every branch of our culture. Historians employ it to dramatize the conflicts and struggles of a people. Literary and art critics glibly explain the genesis of genius by its magic. Philosophers build systems upon it. Sociologists excuse social injustice in its name. Politicians and demagogues inflame the passions of their people with racial slogans in order to cloak economic and political antipathies. Eminent writers and the common man, both bred in the tradition of race, use its terminology unthinkingly and contribute to its abuses. Justifiably, Mr. Barzun demolishes these forms of racial thinking which serve to conceal fundamental motivations and which have no basis in reality.

The idea of the racial classification of mankind was born of the zoölogical and anatomical studies of the 17th century. But these racial divisions were not to remain purely zoological for long. They soon acquired psychological, intellectual and moral overtones and attributes which represented the generalizations of contemporary prejudice. As the classifications of race increased in number and grew in complexity, the non-zoological attributes became more detailed and contradictory. Political and national antagonisms were constantly being rephrased in racial terms which were made to reflect the shifting struggle.

In this emotional complex of prejudices the anthropologist, unfortunately, became involved. To some extent, he encouraged racial thinking, although its germs existed long before he appeared. And partly, he was himself influenced by the intellectual ferment he helped to create.

Much of Mr. Barzun's indignation is directed against these non-zoölogical attributes of race. Rightly he insists that there is no well-founded evidence that the contour of the head or the color of the eye have any causal relationship with intellect, personality or morals. Most American anthropologists would, I believe, go the whole way with Mr. Barzun in his attacks on the extensions of race into psychology, history, art, literature, sociology and politics. But in his scorn for these perversions he seeks to demolish the fundamental zoölogical concept of race itself and here he has a more difficult time. This is not the appropriate place to enter into a detailed discussion of Mr. Barzun's views, but it is necessary to say that some of the assertions in his chapter on scientific anthropology are somewhat less than accurate.

Mr. Barzun has, however, done a Herculean job in attempting to clean the Augean stables of race. Those who have felt a revulsion for the extravagant nonsense of Hitlerian anthropology will find in this book a vigorous and learned exposition of a pernicious fallacy. It is about time that the "modern superstition" be called what it is.

H. L. SHAPIRO.

The Golden Bough of Africa

AFRICAN GENESIS

by Frobenius

and Douglas C. Fox

The Frobenius rock paintings have revolutionized modern anthropology Their recent exhibition at the Modern Museum caused a sensation. The African stories told by Frobenius are superb entertainment in their complete frankness, and provide the proofs of Dr. Frobenius's theory of the continuity of culture in Europe and Africa $3.00

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AFRICAN GENESIS

- - - - - - - - - by Leo Frobenius and Douglas C. Fox

Stackpole Sons, New York, $3.75

THIS volume relates about thirty highly entertaining stories derived from the Berbers of Algeria and Morocco, the Soninke and other tribes of the Soudan and the Wahwungwe tribe of Rhodesia. All were told to Professor Frobenius while in these regions to study prehistoric rock pictures, as mentioned among our September reviews, and are thought by the collectors to furnish possible explanations for at least a few of these pictures.

The Berber tales are animal stories and creation myths. The latter account in a partly natural and partly supernatural way for the origin of the human race, as well as some of the animals, for the use of fire, the preparation of food, domestication of plants and animals, the commencement of trade by barter, and the institution of festivals and religious worship. Oddly enough, the culture hero largely responsible for introduction of all these benefits is the ant, also referred to by one of the biblical writers as a model teacher. The Soudanese contributions are in the form of legends and folk tales, more or less epic in character and suffused with spiritual qualities making them literary masterpieces almost equal to those of early historic Europe. As a concluding series there are six short Rhodesian tales, the first being a creation myth of the supernatural type which, however, appears to give woman a large share of credit for the origin of life and culture. There follow four simple stories with more or less obvious morals, and the book ends with a legend which may possibly explain the origin of human sacrifice as an effort to insure rain for the crops. All the stories, in spite of occasional repetition according to set formulas, are swiftly and briskly told. Briefly stated, they remind one often of the Bible,

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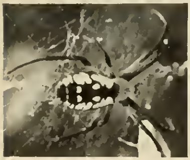

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of Aesop, of European folk tales and occasionally of Baron Munchausen.

Mr. Fox has contributed an illuminating historical and explanatory introduction of help to the special student. Four maps are included to show the geographic location of the story tellers. Lastly, the book has been enlivened by some sixteen illustrations of ancient rock pictures and six full-page pencil portraits which, while interesting, have little if any bearing on the text.

N. C. NELSON.

THE ARTS

- - by Hendrik Willem Van Loon

Simon & Schuster, $3.95

DOCTOR VAN LOON has brought out another of his inimitable personally conducted tours—this time through the Arts. You get aboard the bus just as you did when he took you adventuring through Geography or Ships or Mankind and then you sit back and listen to his delightfully informal lectures. There may be no royal road to learning but Doctor Van Loon has found an awfully good alternate route. And in this tour, as in all the others, the high poundage of information for the trifling effort expended is just about the most attractive proposition of its kind.

Of course, you learn all about what Doctor Van Loon thinks about the arts rather than what the specialists think about them. And the latter, in the several goings over they have given the book, have taken the good Doctor to task for the liberal scattering of inaccuracies they have ferreted out from among the nearly 700 pages of his text. Then, too, they haven't approved of the quite unprecedented way of illustrating the book. For it is here that *The Arts* makes its most daringly violent departure from all previous works on the subject. Partly to save you the expense of paying for photographic reproductions of the master works of art (which, he points out, you can find in the museums and standard academic treatments anyway) and partly, I think, to keep the tour exclusively under his own charming supervision—the Doctor, bravely, does all the illustrations himself. No matter what they purport to represent, all of them, in color, line, or wash, are inevitably original Van Loons. Sometimes they vilify, horrifically, the technique under discussion. Other times they bring out with peculiar clarity the point he is trying to make.

Messrs Simon and Schuster have produced, in *The Arts*, one of their finest books from the viewpoint of arrangement, typography and decoration. Everything, from the framable dust jacket to the catalogue of worthwhile phonograph records, makes it a very desirable volume to own. But against all this there is one serious fault. Doctor Van Loon is reported to have taken 30 years to write the book. That the specialists have found him inaccurate in a number of instances is no great matter (even though you would think 30 days' research out of 30 years' writing might have pruned away many an error in fact). The truly depressing thing is the amount of literary bathos which Doctor Van Loon has managed to set down in 30 years. Many of his phrases are so carelessly contrived—some of them are downright sloppy—that in one or two chapters you begin to wonder if he hasn't let the Arts down rather badly.

D. R. B.

GRASSROOT JUNGLES

- - - - - - - - by Edwin Way Teale

Dodd, Mead and Co., $3.75

IT is indeed a pleasure—and an all too rare one—to find a new book on insects that can be recommended without serious reservations to general readers, young and old. The present one is such a book.

The more than a hundred photographs are exceptionally clear, as all of us who have tried such work will cheerfully acknowledge. Possibly an unduly large number of them feature the Oriental mantis* that came to Philadelphia many years ago and is now spreading or being spread rather widely in this country; but this grotesque foreigner is an almost irresistible camera subject.

The text is not at all technical and the author has neither "written down" nor "jazzed up." It is a series of about a score of short, readable essays concerning common insects, spiders, and "harvestmen." A man with insect photography as a hobby shows us selected examples of his "several thousand" pictures and tells us some of the things that either he has seen in watching the interesting creatures that any of us can watch or he has learned in reading about them. The things that he tells are varied and, so far as we know, true. There are a few verbal slips that the ultratechnical might quibble about but they are really unimportant. The author quotes a comment of Izaak Walton about some other work: "If you like not the writing, I commend you to the pictures." Both are to be commended in this case.

FRANK E. LUTZ.

THE EINSTEIN THEORY OF RELATIVITY. Part 1: The Special Theory.

Text by Lillian R. Lieber; Drawings by Hugh Gray Lieber (H.G.L.R. Lieber, Publishers, 258 Clinton Avenue, Brooklyn, N. Y., 1936)

and

RELATIVITY THEORY OF PROTONS AND ELECTRONS,

by Sir Arthur Eddington (Macmillan Co., 1936).

OF some ten or a dozen books on relativity, that I have read, I believe this little book by the Liebers is the simplest and clearest, as well as the briefest. Beginning with the Michelson-Morley experiment of 1887 to test ether drift, the authors have shown step by step how Einstein developed his famous special theory of relativity set forth to the scientific

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*In answer to many queries received at the Museum it should be said that this insect was *not* introduced to combat the Japanese Beetle and is of little or no value in that connection.

world in 1905. The contribution of the Dutch physicist, Lorentz, known as the "Lorentz contraction," or the "Lorentz-Fitzgerald contraction," is included at the proper stage, and Lorentz transformation is explained in the stride of the argument. It is also shown how Minkowski aided in developing the general theory of relativity, which grew out of the special theory, by which Einstein derived "a new law of gravitation, much more adequate even than the Newtonian law, and of which the latter is a first approximation".

In discussing the necessary abandonment of our old ideas of absolute measurements of length, time, and mass, and the adoption of a four-dimensional Space-Time world, the authors have not only given evidence of a thorough familiarity with original sources, but have referred to the exposition of such writers as Jeans and Eddington.

In *Relativity Theory of Protons and Electrons,* Sir Arthur says that he has endeavored to give a connected account of a series of investigations in the borderland between relativity theory and quantum theory, and that it begins where his earlier book, *The Mathematical Theory of Relativity,* leaves off—at the point where in our survey of nature we encounter the phenomenon of atomicity. Instead of treating matter as continuous, as is done in the usual theory of relativity, the author considers matter, as shown by experiment, to be composed of multitudes of units, and, as he states, he has sought a harmonization, rather than a unification, of relativity and quantum theory.

The book, which is divided into two parts, namely, "Wave-Tensor Calculus," and "Physical Applications," has as its starting point Dirac's wave equation of the electron, the bridge between quantum theory and relativity theory. Naturally the treatment is highly mathematical, yet it is presented with ease and clearness, characteristic of the books by this well-known mathematical astronomer.

CLYDE FISHER.

LIFE LONG AGO: The Story of Fossils

- - - - - - by Carroll Lane Fenton

A John Day book: Reynal and Hitchcock
$3.50

HERE is another addition to that rapidly growing list of books dealing with fossils in a popular way, and, to my mind, it is one of the very best of them.

The book has been written to appeal especially to young people or, as the publishers state on the jacket, "for boys and girls of the inquisitive age." Having accomplished this appeal in an admirable way, the book, like the mechanical toy, is readily absorbing to the grown-up. The 280 pages, plus index, of this volume are divided into 54 short chapters. Of these, except for the introductory and closing chapters, each deals with a distinct group of animal life and they are arranged, so far as possible, in the proper geologic sequence, from the one-celled creatures of Pre-Cambrian time to the Pleistocene mastodons, saber-tooth cats and ground sloths.

Of equal interest and importance with the text are the numerous illustrations. These for the most part excellent drawings are done by the author in a uniform technique, a distinct advantage in a work of this sort. Many of the drawings are of fossil specimens, others are restorations of the various animals, some of which, especially among the invertebrates, are original with the author and the rest are adapted from the restorations of Knight, Horsfall, and others. Five of the dinosaur restorations are in color and have been borrowed from the Sinclair Dinosaur Book. These are drawings made by Mr. James E. Allen, under the supervision of Dr. Barnum Brown. The colored frontispiece, also from the Dinosaur Book, is a Chart of the Earth's Ages. In addition there are several pages of photographs of specimens both in the field and in museums.

The opening chapters are devoted to an explanation of what fossils are, how they got into the rocks and what they mean to us today. The closing chapter gives lists of books on this and kindred subjects for both young and adults, and there is also a list of the great museums of North America with a note stating for what types of fossils each institution is particularly famous.

One important chapter deals with scientific names and the reader is told how these names are made and of the necessity for forming them of Greek and Latin roots. Each generic name has its meaning given and (in parenthesis) its proper pronunciation, which should help to remove

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edited by CHARLES TATE REGAN
Director of British Museum

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a good deal of the terrifying aspect of palaeontologic nomenclature.

Throughout the book an effort is made to create an active interest in fossils: the youth is encouraged to go into the field to collect fossils himself and is told how to go about it.

This is not a text book, but as a readable story of the history of animal life on the earth, written by a teacher in palaeontology, it is most heartily recommended.

W. G.

WATCHING WILD LIFE

- - - - - - - - - by Phyllis M. Bond

Longmans, Green and Co., London, 1937, $2.40.

MISS PHYLLIS M. BOND has written a delightful account of her experiences in search of birds and mammals of the English countryside. Her advice to would-be searchers is excellent for she is an expert in the field with notebook, bird glass and camera. Her photographs lend much to the charm of the book. No detail is omitted as we read:

"You must avoid staring directly at the small, shy creature, cultivate a squint, and watch out of the tail of the eye while apparently gazing at something else.

"If you must take cover, stalking on the hands and knees is generally clumsy and apt to be noisy. . . . The beginner's mistake is generally to progress with face close to the ground, waist humped high in the air, an attitude in which the stalker sees nothing, but presents the arresting appearance of a tweed camel."

Miss Bond's humor saves the day on many occasions, both in the book and in the field. One gathers that she has a perfectly splendid time in fen, hedgerow, dell, copse and marsh, wearing her "old Burberry, toning unobtrusively with the salt-blown grass and last winter's wrack. . . ." A red squirrel, mistaking Miss Bond for a tree-stump, pounced upon her back, brushing her neck with his whiskers. Miss Bond remarks that, on discovering his mistake, the squirrel left her speechless with, "his torrent of abuse."

In a light and airy fashion, the author finds her way amid the various mysteries of everyday nature. We could guarantee a good time to anyone who followed in her footsteps. Here is sound information aplenty; bird searchers will enjoy the book particularly, for one will discover one's own ideas and experiences delineated here in a delightful style.

WILLIAM H. CARR.

THE BOOK OF WILD PETS

- - - - - - - by Clifford B. Moore

G. P. Putnam's Sons, $5.00

CLIFFORD B. MOORE has written an excellent book that will be of service to many who seek information concerning the maintenance of home, school and camp "zoos," nature rooms, and out-of-door museums. *The Book of Wild Pets* is a fine compilation of information, garnered from many reliable sources, relating to the capture, care, feeding and exhibition of animals including crustaceans, spiders, insects, amphibians, reptiles, fish, birds and mammals.

The author has shown considerable perseverance and discernment in his efforts to secure information from various dependable sources. He has made free use of material from organizations including the American Humane Society, the Audubon Society, the American Museum of Natural History, the New York Zoological Society, the Biological Survey and many others. His zeal to gather information and illustrations has resulted in a highly interesting compendium.

Mr. Moore writes simply and employs non-technical terms, with considerable originality, to describe the establishment and care of various types of fresh and salt water aquariums, three kinds of terrariums and details concerning the plants and animals for each. There are numerous adequate descriptions, diagrams and plans for the construction and use of traps, cages, pools, feeding stations, bird houses and similar devices to enable the reader to secure and house wild pets.

The large, attractively illustrated book is well balanced and provides a comprehensive treatment of each subject. The arrangement of topics is satisfactory, too. Regardless of this, it was something of a mystery to this reviewer to encounter the description of slugs and snails separating the snakes and the turtles. One might brood upon several mysteries of this sort, although they in no way impair the general accuracy of the work.

Mr. Moore's book will be of service to teachers and others in the field of natural science who often receive inquiries from pupils on, "How shall I keep my newt now that I have it?" and "Will my blacksnake bite me every time I try to feed it?" Indeed, *The Book of Wild Pets* will answer endless, "Where, Why, When, and How" questions, concisely and clearly. It is a good book to recommend to adults and children alike. Camp Nature Leaders will do well to make its acquaintance.

Despite the fact that this is in effect a manual, it is nevertheless distinctly readable. The author's accounts of his own experiences with wild pets are enjoyable and stimulate one to, "go thou and do likewise." Of particular value are the life history and identification notes. Mr. Moore, who is a patient observer of wild life, in captivity and out, has been well rewarded for his patience and diligence. His success in rearing animals is amply demonstrated in the useful pages of *The Book of Wild Pets*.

WILLIAM H. CARR.

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SCIENCE IN THE FIELD AND IN THE LABORATORY—*Shiva Temple Artifacts—Rare Swordfish Specimen—Dinosaur Collections—Colombia Expedition—Museum Visitors' Radio Program—Lectures—Awards*

Shiva Temple Artifacts

The incidental archaeological results of the Patterson Grand Canyon Expedition to the Shiva Temple mesa were presented to the Department of Anthropology on their arrival early in October. The material consists of forty worked flint items and twenty-four potsherds. Among the flint objects, besides a small core and numerous simple angular and oblong prismatic flakes, there are three rough blanks or unfinished implements, one crude endscraper, one crude perforator, one well-made fragmentary drillpoint and two well-made fragmentary spearpoints. Of the potsherds, some belong to jars of either plain gray unslipped or plain white slipped wares; others indicate bowls with a whitish slip and traces of black painted designs on the inside; and the remainder represent jars of the coiled or corrugated type. The corrugated ware alone gives a fairly definite clue to the time period involved, and this is neither very early nor very late in Pueblo culture history but appears to represent what in archaeological parlance is called the Pueblo II period, or about 1000 A.D.

Dr. Harold E. Anthony, leader of the expedition, states that the Shiva Temple mesa is strewn with flint nodules which have weathered out of the underlying limestone formation, and it seems probable that the Indians of long ago visited the place primarily for the purpose of obtaining flint for the production of tools and weapons.

Dinosaur Expedition Returns

Ranging from a large assortment of Cretaceous plants to an enormous slab of rock on which a gigantic Iguanodont left his 34-inch footprints about 80 million years ago, so placed as to indicate a coverage of fifteen feet in a single stride, the collections of the American Museum-Sinclair Dinosaur Expedition show the result of some of the most fruitful excavating work done in many years.

During its explorations in Wyoming and Colorado in the latter part of October, the Expedition also secured parts of eight dinosaurs from the Mesaverde Cretaceous formation near Rock Springs, Wyoming (a division of the Cretaceous from which up to this time dinosaur bones have never been taken). One of the specimens is a mountable Trachodont skeleton and another represents an entirely new family of dinosaurs. Other important specimens taken were a perfect skeleton of a Green River Eocene crocodile with all plates in position and, from the Bridger and Washakie basins near Rock Springs, a small but interesting collection of reptiles and mammals.

Mr. Albert Thomson, financed by a grant from the Pliocene Fund, spent a part of the summer in the White River badlands of South Dakota where he secured a considerable collection especially rich in sabre-tooth cats of two or more genera and in rhinoceroses.

The American Museum-Sinclair Dinosaur Expedition was also aided by the Pliocene Fund, but was mainly financed by the Sinclair Refining Company, the Union Pacific Railroad Company, and the Union Pacific Coal Company. Personnel of the Expedition included Dr. Barnum Brown (leader) and Mrs. Brown, Dr. Erich M. Schlaikjer, Dr. G. Edward Lewis, Roland T. Bird, Robert G. Chaffee, Gil Stucker, G. D. Guadagni, and James Ryan.

Two views of the medal recently presented to Dr. Roy Chapman Andrews

SOCIETAS GEOGRAPHICA HUNGARIAE 1872
ROY CHAPMAN ANDREWS

Honors and Awards

Dr. Roy Chapman Andrews, Director of the American Museum, was recently awarded the Loczy-Medal by the Hungarian Geographical Society. The medal (illustrated on this page) is given in recognition of important exploratory work done in Asia.

In his letter of announcement to Doctor Andrews, Professor Dr. E. de Cholnoky, President of the Hungarian Geographical Society, wrote:

"The Assembly unanimously approved and accepted with great enthusiasm the motion, that the Loczy-Medal of present year should be awarded to you in recognition of your scientific work and merits. Will you kindly accept as a token of our deep appreciation, the Medal which we enclose as an expression of gratitude for all that you have done in the name of Science?"

At the thirty-third annual convention of the National Association of Audubon Societies, held in New York City, October 22-26, 1937, Dr. Frank M. Chapman, who retired as a Director of the Association, was elected Honorary President, the first time that this office has ever been filled. The wording of the resolution by the Directors indicated that Doctor Chapman's term was to be for life.

At the same meeting Doctor Chapman was tendered, in recognition of his thirty-two years of service, a silver loving cup bearing the following inscription:

FRANK M. CHAPMAN
In token of our affection and esteem
from the
Members of the Board of Directors
of the
National Association of
Audubon Societies
October 1937

Dr. Robert Cushman Murphy, who has been Treasurer of the Association during the past decade, was elected President, succeeding Mr. Kermit Roosevelt, who still remains a member of the Board.

At the annual meeting of the Long Island Biological Association, held at Cold Spring Harbor on September 17, 1937, Doctor Murphy was elected a member of the Board of Directors of the Laboratory for a four-year term.

Doctor Murphy's Colombia Expedition

Dr. Robert Cushman Murphy returned early in October from a reconnaissance of the Pacific coast of Colombia, which is regarded by geographers as the least-known stretch of continental sea coast remaining in the world.

The United Fruit Company's 90-foot Diesel cruiser *White Shadow* had been placed at the disposal of the Museum for this work through the generosity of Mr. E. Hope Norton. The *White Shadow* broke down, however, and Doctor Murphy, with two companions, undertook to carry out as much as possible of the planned investigations in a 38-foot launch provided as a compromise by Mr. Norton. In this craft the voyagers covered 1065 miles during September, skirting the entire coast between Panama and Guayaquil, Ecuador. Despite constant head winds and currents, the squalls of one of the rainiest regions in the world, the very imperfect existing charts, and the shortcomings of a craft never designed for a long ocean voyage, a fruitful program of both oceanographic and zoological work was carried out. This will be fully reported upon after a study of the specimens, water samples and instrumental records obtained during the voyage. Four hundred and fifty miles of Pacific Colombia, much of which is made up of very spectacular tropical sea coast, proved to have an extremely thin and scattered human population, and throughout this extent there is not one lighthouse or other beacon.

Mr. Jesse Metcalf of New York, a Life Member of the Museum, presented funds to cover the cost of equipment and incidental transportation. The Woods Hole Oceanographic Institution and the United States Coast and Geodetic Survey lent valuable oceanographic instruments, and the American Geographical Society provided Doctor Murphy with photostats of all maps of the Pacific coast of Colombia and with much related information.

Bird Department Activities

On September 28th Dr. James P. Chapin returned by way of Belgium from the Belgian Congo, bringing with him a number of specimens of his striking new African Peacock of which he had been in search. A full account of the discovery and subsequent history of this bird is given by Doctor Chapin in his article published in this number of NATURAL HISTORY. Doctor Chapin has been studying for the past year at the Congo Museum in Tervueren, Belgium, at work on the completion of the second part of his monograph on the "Bird-Life of the Belgian Congo." The early publication of this nearly completed portion is expected.

Mr. E. Thomas Gilliard, of the Department of Ornithology, left New York on October 14th en route to Caracas, Venezuela, where he is making arrangements for the coming of the remaining members of the Phelps Venezuelan expedition.

Mr. Philip B. Philipp has joined the Department as Research Associate in Oology. He is planning to bring his magnificent collection of birds' eggs to place on deposit at the Museum where it will form a splendid adjunct to the Museum's own collection. Mr. Dean Amadon has been made an Assistant in the Department to help Mr. Philipp in the arrangement and care of the birds' eggs and nests.

Mr. Austin L. Rand has been made Research Associate in Ornithology. Mr. Rand has been active for several years in the study of the birds of New Guinea, having been a member of two expeditions to that country financed and led by Mr. Richard Archbold.

New Acquisitions

The large adult swordfish is well known and is represented both in the Museum Fish Department's study collections and in the Hall of Fishes of the World by large specimens taken on Museum expeditions. But it is rarely in these waters that the smaller, younger stages of this fish are captured, and up to this week the department has not had a chance to study one of these. The Fish Department, therefore, was exceedingly grateful for the acquisition of a small swordfish weighing about 11 pounds, and measuring a trifle over four feet, including the sword, which came to them through the generosity of Teddy's, the House of Sea Food, in Fulton Market.

The small specimen shows marked differences from the larger fish, both internally and externally, but very probably represents the very smallest size at which young swordfish are essentially like the adult (the smaller swordfishes are so unlike their parents that they are scarcely recognizable as the same fish). The most noticeable external differences to the casual observer are the presence of scales all over the body of this small specimen, whereas the adult fish is completely scaleless. This specimen also has a long dorsal fin, only the high front portion of which remains in the adult.

The fish is being studied in detail by the Departments of Ichthyology and Comparative Anatomy and will be exhibited in the Hall of Fishes of the World.

* * *

The Department of Ornithology has acquired a fine collection from southern Borneo. This region was poorly represented in their previous collections and is important as being a type locality for many Bornean species. In addition to a number of forms unrepresented in earlier material, seven new subspecies have already been discovered in the current study of this collection.

12 SUPERB AUDUBON ETCHINGS — COLORED BY HAND

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Exhibit of Mexican Children's Art

Through Mr. Angel Rosas, Delegate of the Ministry of Education of the Mexican Government, the Mexican Children's Art Exhibit has been placed on view in Education Hall from December 2 to January 3. The exhibit includes art work (painting, modeling and craft work) done at various public schools in Mexico, including the school of fine arts and the theatre and dance school. Photographs will also be on view from the Department of Archaeology and Colonial Monuments showing various types of Indians, churches and buildings of the colonial period, and the ruins of Teotihuacan, Mitla and Chichen-Itza.

The Return of Dr. G. H. H. Tate

The 1936 Archbold New Guinea Expedition was terminated by the return of G. H. H. Tate on September 17th via Europe and Canada. After the Fly River work of the party had been completed*, Doctor Tate, with a small party of natives, put in another three months of intensive field work inland from Port Moresby (where the accident to the Archbold plane had occurred). The territory worked was the Astrolabe Range, scene of a recent gold rush, and the broken uplands connecting the Astrolabe with the Central Range of Papua which towers up to 14,000 feet. Collecting was done at a number of stations between 1000 and 5000 feet in heavily forested, often extremely rugged, territory. The limestone caverns of the valley of the Musgrave River were visited and several species of bats were taken there. Those caverns are the home of cave-nesting swifts which build their nests in the total darkness of the remoter recesses of the caves. The prime objective of this branch expedition was the capture of topotypes of a number of species already known from the Astrolabe region; but in addition to the topotypes sought, one (and possibly more) entirely new form of mammals was secured.

The work in Papua completed, Doctor Tate sailed for Naples. He was joined at Genoa by Mrs. Tate, and the succeeding months were passed in going over the type material contained in the museums of Genoa, Berlin, Leiden, London and Paris. It is expected that the data and photographs resulting from the European research work will aid very materially in the successful working out of the Papuan and Australian collections in the Museum now waiting determination.

Doctor Tate left last month for South America as leader of the Phelps Venezuela Expedition, details of which are given in Dr. F. M. Chapman's article of this issue.

Museum Visitors to Broadcast

Starting Saturday, October 30th, at 12:50 noon, EST, under the auspices of its Ten Year Development Program for Educational Extension, the American Museum of Natural History begins a Saturday question and answer program entitled "This Wonderful World" over the coast to coast facilities of the Mutual Broadcasting System.

The program will come directly from the 77th street entrance of the Museum. Taking part in it will be visitors from all over the country who happen to be in the Museum at the time. Mr. Robert Emory of the Mutual Broadcasting Staff, and Mrs. John R. Saunders, Staff Assistant of the Department of Education of the American Museum, will be in charge of the program. Each week there will be three main prizes for the best questions and answers on natural history subjects sent in by the listening radio audience, the first prize being associate membership in the Museum for one year.

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*See article by Archbold and Rand in NATURAL HISTORY for October, 1937.

New Books for Natural History Readers

AMERICA'S YESTERDAY

ARCHEOLOGY is one of the most fascinating subjects in science, and this latest, completely up-to-date book brings you a vivid, exciting account of early peoples in North and South America. It describes in detail the long-puzzling source of man on this continent, and presents a colorful, authentic account of the lives and cultures of those three great civilizations that once inhabited the Southwest of our United States—the Aztec, Maya, Inca. The book is magnificently illustrated with more than seventy half-tone paintings and fifty line drawings. At all bookstores. $3.50

By F. Martin Brown

Lecturer in American Archeology at Colorado College

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EARLY MAN

As depicted by Leading Authorities at the International Symposium, The Academy of Natural Sciences, March, 1937

Edited by GEORGE GRANT MacCURDY, Director of the School of Prehistoric Research. Introduction by John C. Merriam, President, Carnegie Institution of Washington.

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A THOROUGHLY absorbing story of changes the Earth has undergone since the earliest known era, the significant changes that are occurring even in the day we live. There are many maps by Helene Carter in full color, which convey to the reader's mind a clear, striking picture of how tides, earthquakes and many other disturbances have affected the surface of the world, the weather and the people who live on it. For both juveniles and adults. $2.50

By Jannette May Lucas

In charge of the Osborn Library of Vertebrate Paleontology of the American Museum of Natural History,

and Helene Carter

Who illustrated such well-known Ditmars' books as "The Book of Zoography", "The Book of Living Reptiles", "The Book of Prehistoric Animals", etc

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Calendar of December Lectures

December 2

Education Hall: Opening of Mexican Children's Art Exhibit (through January 2)

8:15 P. M. Lecture to Members: Colorful Courtships of the Animal World, by Dr. G. Kingsley Noble

December 3

10:30 A. M. Lecture to Public School Children: Necessities of Life, by Dr. Wm. Lord Smith

1:00 P. M. Above lecture repeated

December 4

10:30 A. M. Lecture to Children of Members: Our Animal Friends and Foes, by Dr. Raymond L. Ditmars

12:15 P. M. Radio Broadcast from Museum foyer: "This Wonderful World" (Question and answer program by Museum visitors)

2:00 P. M. Free Motion Picture on Bottom of the World

3:30 P. M. Motion Picture for Adult Students' Association: The Life of Louis Pasteur

December 7

3:50 P. M. Biology Lecture: South for the Solar Eclipse, by Dorothy A. Bennett

8:15 P. M. Know Your Museum Meeting for Members: The Emergence and Evolution of Land-Living Vertebrates, by Dr. William K. Gregory

December 10

10:30 A. M. Lecture to Public School Children: The Story of Writing, by Marguerite Newgarden

December 11

12:15 P. M. Radio Broadcast from Museum foyer: "This Wonderful World" (Question and answer program by Museum visitors)

2:00 P. M. Free Motion Picture on Beaver Ways

December 14

3:50 P. M. Biology Lecture: Man's Place Among the Vertebrates, by Dr. Wm. K. Gregory

December 16

8:15 P. M. Lecture to Members: Jungles Calling, by Osa Johnson

December 17

10:30 A. M. Lecture to Public School Children: The Silent Enemy (Motion Picture)

1:00 P.M. Above lecture repeated

December 18

10:30 A.M. Lecture to Children of Members: Hunting Giants of the Sea, by Chester Scott Howland

12:15 P. M. Radio Broadcast from Museum foyer: "This Wonderful World" (Question and answer program by Museum visitors)

2:00 P. M. Free Motion Picture: The Silent Enemy

December 21

3:50 P. M. Biology Lecture: The Life of Louis Pasteur (Motion Picture)

8:15 P. M. Know Your Museum Meeting for Members: The Adaptive Radiation of the Reptiles, by Dr. William K. Gregory

December 25

12:15 P. M. Radio Broadcast from Museum foyer: "This Wonderful World" (Question and answer program by Museum visitors)

December 27

3:00 P. M. Special Christmas Holiday Program of Motion Pictures: Simba

December 28

3:00 P. M. Special Christmas Holiday Program of Motion Pictures: The Silent Enemy

December 30

3: 00 P. M. Special Christmas Holiday Program of Motion Pictures: Trail-Mates

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APPLICATION FOR MEMBERSHIP

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THE FACTS ABOUT SHIVA

Continued from page 721

along the rim, along fallen logs in the forest, and under clumps of low bushes in the more open spots. Everywhere the mice were abundant, three or four varieties of them. Chipmunks were common and over-ran Shiva, and two distinct varieties of wood rats or pack rats lived among the rocks and, less frequently, among the trees. Cottontail rabbits were fairly common and rock squirrels, similar in size and general appearance to our Eastern Gray Squirrel, frequented certain favored spots.

Porcupines occur on Shiva, or did, for I found the quills of one piled up in a ravine where they had been washed by the run-off from a storm. The ring-tailed cat or cacomistl doubtless lives among the rocks along the rim, since it is found throughout the canyon, and I have it to thank for the mutilated bodies of several wood rats trapped there. I saw the tracks of a coyote, made in the mud after the rain, which visited Shiva while we were there. This animal is probably only an occasional visitor for we saw few fresh signs.

The black-tailed deer comes up onto the plateau in winter for we found quite a few antlers, which are dropped in January or February, and no evidence of any on the top while we were there. At first it was a little puzzling to figure out how deer could get onto Shiva, since most of the perimeter presents such bold cliffs. This variety of deer lives in broken country, it occurs throughout the canyon region, and is a good climber. Even so, it does not seem possible that it could cross over from the North Rim by the route we followed. The south face of Shiva seems to offer better possibilities for here the Coconino has been broken down, by weathering, in more places than on the northern exposure, and it should be easier to scale than where we attacked it. However, to reach these particular spots, a deer or a man would have to travel a long and tedious distance either from the North Rim or up from the river bottom, most of it along steep slopes of loose, fallen rock. This footing is bad for man and that is why we avoided it; although it would not be particularly troublesome for the black-tailed deer which lives in such regions. Wandering about Shiva on these talus slopes, the deer could avail itself of the few breaks in the cliffs to eventually arrive at the top. A study of the photographs will disclose that nowhere else could the cliff barrier be passed.

The cougar or mountain lion probably follows the deer up upon occasion. This completes a list of some twelve mammals either resident on Shiva the year around or visiting it during the year.

Without exception, all of the mammals active during the day were shy and fearful of man. They are, of course, unaccustomed to him, but hawks are common on Shiva and they have learned to run whenever they see something moving. Chipmunks, cottontails, and rock squirrels invariably went into high gear when they saw us, which was usually before we saw them.

In marked contrast to this behavior was that of the nocturnal mammals about camp. Until we had rain to drive us to sleeping in the tent, we had our sleeping bags laid out under the trees. My bed was visited one of the first nights by a venturesome mouse which discovered entrancing possibilities on the canvas flap thrown back from my head. This made a flat ballroom floor for him and he scampered back and forth across it, having a fine time. He was not over six inches from my head but that did not bother him nor me, although I made the mental reservation that if he fell in my ear or tried to take some of my hair for nest material, something I could ill afford to spare, I would have to get up and eject him.

Later, in the tent, the same mouse or his brother visited us nightly and, because quarters were cramped, ran past my head so close that I could feel him in my hair. I put up with this for one night, but we had our now rapidly diminishing food supply in the tent and the mouse was bent on getting into it. He would scamper out of the tent when one of us got up to shoo him but would be back before we were scarcely settled in bed again. He finally came to the end of our patience and wound up as a museum specimen.

We had other nightly visitors besides mice. My first night under a spreading juniper indicated that we might be troubled by insects. Soon after I crawled into my bed I heard the high-pitched whine of an insect. It sounded like a big, high-powered mosquito, and I waited for it to settle on my face or hands. I wondered a little at the presence of mosquitoes where there was no standing water, but knew that it was possible for these insects to fly or to be wind-borne up from the river-bed. It would not settle down nor would it leave, and I fell asleep speculating on whether it really was a mosquito so out of practice on a man that it did not know what was expected of it. Before I lost interest in Shiva for the night, however, I felt activity down inside my sleeping bag, one or two ants on the prowl and big ones. I hoped I had not put my bed down on an ants' nest. I recalled an occasion when I made up my bed after sundown, rolled a few rocks away, and did just that. Ever since I have had a keen appreciation of the saying "he has ants in his pants." But the ants, like the mosquitoes, did not bite and they stopped tickling my legs before I decided that it would be necessary to get up with a flashlight and take stock of things. Each night thereafter an ant or two would make the rounds of my anatomy in the sleeping bag. I put the flashlight on one and it was about half an inch long, black in color, and the same kind of an ant that was eating the mice caught in our traps. Man was something new in their experience and they were just curious.

We had been on Shiva several days and things were progressing favorably when the packers brought a note from Superintendent Tillotson asking for a brief statement of progress for the reporters. I had managed to forget them by this time, although the daily visits we were having from planes told me that there was still considerable interest in the expedition. While the packers waited to take my message over to the Rim, I dashed off a reply to Tillotson. We had no writing paper so I tore off a large piece of brown wrapping paper, wrote a serious statement of what we were doing, told Tillotson he could show any or all of the letter to the press and signed the letter.

Then I thought of some of the trival things that had happened and considered he might like to know them. In a facetious mood I wrote a column on the margin of the letter and headed it "Shiva Daily Gazette." I told of the headless mouse that had fallen into my hand when we pulled the first 'chute out of the trees, of the large ants that came into my sleeping bag, of the mosquitoes, "big as nighthawks," of the fire about 4:00 a. m. that destroyed the tent on the North Rim, and similar items. I sent the message down and forgot about it.

The letter went out to Tillotson on the South Rim via the short-wave radio at the base camp and I discovered that I had started something. Word came up by the packers that the "Gazette" had gone over big and was it really to be a daily affair. I did not write another, but I was to hear about it in surprising ways.

When I received my accumulated mail at the Grand Canyon Lodge, I found three communications referring to the "Gazette." One was a letter containing a quarter to pay for a copy of Volume 1, Number 1, of the "Shiva Daily Gazette." The writer was saving first editions and wanted a copy to frame. There was also a large carton, sent by air mail, containing a dozen bottles of mosquito "dope" to try out on Shiva.

Within a week of the time this account was written, I received a letter addressed to "Shiva Temple" and forwarded to the Museum. This contained fifty cents to pay for a subscription to the "Shiva Daily Gazette" and if this was not enough more would be sent. Apparently Shiva needs a newspaper, and one of the "firsts" I think I can claim without fear of contradiction is that I published the first newspaper on Shiva!

Pueblo Indians, not much later than about 1000 A. D., climbed Shiva Temple to collect flint and to harvest mescal. We found an abundance of flint chips and a few definitely shaped artifacts such as spear points, scrapers, perforators, et cetera. Many flint nodules occur in the Kaibab limestone which caps Shiva, and this locality was apparently a favorite source of supply, to judge from the frequency of the scattered piles of flint flakes.

The Peublos were cliff-dwellers and it would have been more surprising if they had not visited Shiva. The archæologists have the data to date this period of Indian occupation (Pueblo II period) as, roughly, 900-1100 A. D., and these Indians had disappeared before the first Spaniards saw it.

I saw that we would have a representative collection of the mammals on Shiva by the 25th or 26th of September, which would give us about ten days there. George Andrews was needed in the climbing party which was exploring a possible route to Wotan's Throne while we were collecting on Shiva. I had Ray Young, one of the packers, bring his bed up to camp to help in Andrews' place and sent George to join Wood. What happened on their survey is told by George Andrews in an article in this issue of NATURAL HISTORY.

The collection from Shiva is now in the Museum and it may well be asked what the expedition has accomplished. Answering in broad general terms, the expedition has been successful for it has surveyed the mammal fauna and secured an adequate sample of that life to afford a basis for research. The skulls are now cleaned and ready for examination.

We did not know in the beginning what these specimens would disclose, if mammals proved to be on Shiva. We knew that they might be identical with those on the North Rim. If this were so, we would still have done something constructive because, until the specimens were taken, no one could say whether they were different or not. It was hoped that some species of mammals on Shiva had been completely isolated and would show significant differences from their mainland relatives.

The present mammal denizens of Shiva are all active, climbing types and, as far as physical barriers are concerned, are capable of crossing from the rim of Shiva as conditions exist today. When the Shiva specimens are compared with the series of similar species from the Rim (something that will be done very shortly in cooperation with the U. S. Biological survey which has material from both Rims)*, then it will be possible to discover whether there are measurable differences or if these creatures disregard the hostile environment of the saddle and travel back and forth.

When the mammals worked into the Grand Canyon, following the more favorable climate which resulted as the last glacial period came to a close, some went along the North and some the South Rim. Today so many of these varieties of mammals are different on the two Rims that we know the Grand Canyon itself is a barrier; these particular mammals do not cross from one Rim to the other. The situation as regards Shiva and the North Rim is comparable but differs in degree. We do not yet have a Grand Canyon between Shiva and the North Rim, only a vertical interval of 1300 feet as contrasted with, roughly, 5000 feet. If the forces of evolution have begun to produce visible effects, then one of our hopes will have been realized.

We did not expect to find Dinosaurs; we did not find them. We may have been several thousand years too early to find tangible evidence of evolutionary changes; these will most certainly appear sooner or later, with a set-up such as that on Shiva, and I hope that they have already begun to appear.

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*As this article goes to press this comparison has been made and reveals no noticeable differences between the animals of Shiva and those of the Rim.

SCALING WOTAN'S THRONE

Continued from page 724

we were forced to move slowly and with the greatest care. Reaching the summit of the ridge we stopped and looked about us. Straight ahead the precipices of Wotan looked unclimbable. Walt pointed around to the north, where a broken ridge against the skyline led to the summit.

"If we can get up that, our troubles are over," he said.

Slowly we crawled like giant spiders along the base of the sandstone walls. Rounding a corner, we suddenly came upon our ridge. We peered up at the broken crags and boulders above, picking out the route ahead, trying to visualize every hand and foot hold.

Deliberately Wood started up the first pitch, climbing rapidly but with great care; as we followed, mounting higher and higher, we prayed inwardly that at this final moment, with success within reach, we would not be met by an unclimbable wall.

A welcome shout came from above, "One more pitch and we're there!"

Hardly daring to believe him, we moved up and suddenly came out of the shadows into the blinding light of the summit.

Wood stood there against the skyline. "Well done everyone," he said, as one by one we crawled over the rim. "Here, pass the canteen—one swallow apiece in celebration."

The smoke of our signal fire curled lazily upward in the still air. Far away on the North Rim we could make out a few animated black specks moving about, and a thin, far-away hail drifted across the canyon in answer to our fire.

The summit was a tangled mass of deadwood and scrub pine. Preston started across in search of water on the far edge of the mesa. As we explored inland, our progress was almost halted time and again by matted brush and windfalls. Not far from the rim, I stumbled across a small circular mound of rocks, built up a few feet from the ground; evidently an old "yant' oven, used by Indians to bake mescal roots. It was not surprising to find this Indian sign, as we had discovered similar remains on Shiva Temple, but I wondered what attraction such a spot could have had unless it was for protection.

Shortly Preston appeared with welcome news—the discovery of rain water in the rock holes of the southern edge. I would have given almost anything to have stayed on that fascinating spot, but there wasn't time. Our job was to climb the mesa, to lay out a route for future exploring parties and to get down as soon as possible. We had only one hour on the summit.

The descent off the cliffs down the ridges and up the North Rim was comparatively easy. We knew the route and had fixed ropes in the difficult overhangs for our return.

As we trudged up the final slopes on to the North Rim, we all stopped for a moment and looked back into the canyon. Silent and impressive Wotan's Throne rose in the shimmering haze. Despite the fact that our feet had stood upon its summit and that it was untouched ground no longer, it seemed to us that it had lost nothing of its splendor and brooding mystery.

Ghosts on the Timber line

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IN PURSUIT OF THE CONGO PEACOCK

Continued from page 732

guarantee to bring back a single specimen, because I knew all too well the elusive nature of francolins and guinea-fowl in the heavy forest. Yet I could learn something about the habits and distribution of the Congo peacock, and I could insure the collecting of specimens by arousing the interest of white residents and by training natives to assist them in the preparation of the skins. My luggage would have to be light, so I shipped a few boxes with two guns and other equipment to Stanleyville by steamer six weeks in advance. This was the time it would have required for me to go there by ordinary means of transportation. By airplane over the "Sabena" route I could do it in four and a half days.

On the 23rd of May I was delighted to receive word from Doctor Dyleff that he had obtained his first specimen, a female of *Afropavo*, and that it had been prepared by Musoba. This dispelled all fear that I should return empty-handed. The next surprise was the receipt on June 17th of a letter addressed to Doctor Schouteden by the Reverend Wilson of Inkongo, announcing that he had now secured another male of the "peacock" which he was sending to the Congo Museum. He enclosed a photograph of its head showing a great tuft of long whitish bristles rising from its crown at the spot where the type specimen had its patch of short bristles.

Two days later I was saying goodbye to Doctor and Madame Schouteden and a group of other friends at the airport near Brussels. Every possible facility had been extended to me by the Colonial Ministry. I climbed into a great tri-motored plane of the Sabena, the Belgian company engaged in aerial transportation in the Congo and between there and Europe. In less than four hours we landed near Marseilles, where we spent our first night.

Our second night's stop was at Colomb Bechar in southern Algeria, and we went from there across the Sahara to Gao on the Niger in ten hours, inclusive of stops at Reggan and Agueloc. The fourth night found us in a hotel at Fort Lamy near Lake Chad, and by the middle of the next day we were over the mighty Congo Forest. The view from the air of the upper Congo River near Lisala was the most impressive river scene I have ever beheld. Here the Congo is five and a half miles wide, flowing through solid rain forest, and filled with long, narrow wooded islands. At 4 o'clock that afternoon, June 23rd, we came down at the airport at Stanleyville.

Waiting there for me were Pat and Mary Putnam, who live in the Ituri Forest, as well as several Belgian friends. Nkotiba, a bird-skinner I had trained at Lukolela in 1930, breathed a sigh of relief as he saw me. He had been waiting a month at Stanleyville, watching every airplane arriving from Europe, hoping to see me step out.

Mr. Charles de Leuze, who was later to take me to Angumu, handed me a letter from Doctor Dyleff saying he now had four skins of *Afropavo* prepared by Musoba, as well as one flat skin that had been given him by a Russian friend. Furthermore, Pat Putnam told me that Doctor Els, government veterinarian at Stanleyville, was waiting to show me two more "peacocks" injected with formalin.

The two birds which Doctor Els had were killed about a month before at a small mining camp at the Ayena River, 68 miles east of Stanleyville, and sent in by Mr. Philippe de Braconier. One was a male, with the same tuft of long bristles on the crown as Wilson's photograph had shown. These were subsequently placed in a preserving solution and forwarded to Tervueren, so they might be used for anatomical study.

After about five days at Stanleyville I left for Angumu with Mr. de Leuze in his Chevrolet sedan. We took the Ituri Road, over which Herbert Lang and I had trudged for three weary weeks in 1909, with a caravan of about 160 porters. What a change there has been in African travel since then. We spent our first night at one of Mr. de Leuze's coffee plantations, and the next day I made a side trip by truck to the Ayena camp and met Mr. de Braconier. He assured me that the "peacocks" had often been heard at night from his house, and invited me to return and hunt the birds in that vicinity.

I felt that first I must go on to Angumu, meet Doctor Dyleff, and see what could be done there. So late in the evening of June 30th we arrived at the headquarters of Mr. de Mathelin's mining company. Doctor Dyleff, a charming Russian émigré, showed me the skins he had procured for me and designated two of his hospital boys as students in the school of taxidermy I was to open. Pat Putnam sent me a third student, and also a man who was supposedly an expert bird-trapper.

We relied mainly on native hunters attached to the various camps where placer gold-mining was conducted. All these hunters were familiar with the "itundu" as it was called in the Bakumu language, though the bird was not often killed. So much clearing had been done right around the main station of Angumu that there seemed little chance of finding *Afropavo* there. All my informants agreed that it shunned clearings and even second growth, keeping to virgin forest. During the first twelve days of my stay none was brought in by any native, and in my few excursions into the forest and to the neighboring camps I saw no sign of it.

During this period I busied myself with the training of the new skinners. Musoba and Nkotiba acted as instructors, with occasional intrusions by me, and a varied collection of forest birds from the vicinity was gradually formed. I made a point of meeting as many as possible of the Europeans who dwelt in the district, and the main topic of conversation was always *Afropavo*.

On July 13th Doctor Dyleff was to start off for his regular visit to the Ayena camp, and he invited me to accompany him. Remembering what de Braconier had told me, I felt that would be a far better place than Angumu for me to hunt the "peacock." Ayena was a clearing scarcely eight months old, and the virgin forest commenced within a hundred yards of the house where I was so cordially invited to stay. Anyasi, a good native hunter, was placed at my disposal, and together we roamed the forest day after day.

Walking is not very difficult in the virgin forest of the Congo. It is often warm, but the heavy shade renders a hat quite unnecessary. We began by following the crest of the ridge back of de Braconier's house, and then investigated the slopes on both its sides. It was late in the afternoon of the 16th that I first caught a glimpse of the object of my search. The morning had been rainy, the afternoon was very dark, and at 5:20 we had just started homeward. We were ascending a slope when I saw something dark running through the low bushes ahead.

Anyasi saw it too, sprang ahead, spied it once more, and fired. Then followed a tremendous beating of wings as a male *Afropavo* rose from the ground, disappeared behind the leafy trees, and flapped its way out of earshot. Just as Anyasi dashed ahead I had heard another large bird rise from the ground on his right and make off in that direction. Neither bird did I see again.

It seemed to me that with dogs we should have a far better chance of finding our bird. I had seen long ago how much more apt the forest guinea-fowls are to take to trees when pursued by a dog. When on the 17th Anyasi saw another pair of "peacocks" dart off the path and we were unable to flush them, I urged him to bring his dogs along. He had two, not of the native race but of mingled European origins, and they became our constant companions.

Luck was with us these first few days. On the morning of the 18th we were hunting along a steep hillside when I saw Anyasi lower his gun and run forward. He had noticed that one of the dogs was chasing something, but the undergrowth was a little too dense to see what. Now came a bark, and we could hear two large birds take wing. One flew uphill past us, completely invisible. The other rose more vertically and seemed to have stopped in a tree. We pressed forward, looking upward. I saw nothing, but presently Anyasi fired two shots and I heard something fall. He brought me the bird before it was quite dead, an immature male "peacock" in a plumage almost like that of the adult, but without spurs and its bristly crest only beginning to grow. The bare skin of its neck was already scarlet, as it is in old birds of both sexes.

This was the only example I had the good fortune to dissect myself. Its crop contained nothing but rather small green fruits which fall in numbers to the ground from one of the forest trees. But from a hasty examination of the crop of another bird prepared by Nkotiba in my absence I have reason to believe that the diet of *Afropavo* is as varied as that of the forest guinea-fowls.

During the five more days I spent at Ayena we never succeeded in flushing

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another "peacock." To the best of my knowledge only three had been killed there since the establishment of the camp.

Both natives and Europeans had assured me that these birds call loudly only at night. Mr. de Braconier wrote me a careful description of the noise, which begins with a deep "rro-ho-ho-o-a" and goes into a series of reiterated syllables like "gowé-gowah," which may continue with or without pause. Among the Wabali, Anyasi's tribe, these give the bird its name of "Ngowé." The hour when they are uttered varies. It may be soon after nightfall or at any time during the night, and several days may pass without their being heard at all.

Just before daybreak on July 19th, I was told, these cries were heard from two directions. Unfortunately I was not awakened. But during the night of the 20th I had better luck. A little after 10 o'clock I was aroused from my work table by a loud unaccustomed noise and stepped out on the verandah. From the forest to the southward came the "gowé-gowah" just as it had been described, repeated again and again. The "wé" syllable is higher in pitch than the "wah" syllable, otherwise there is little difference.

Later the sounds came from the valley to the north, and were repeated at least thirty times, with occasional interruptions. Again I had failed to hear the introductory notes. Mainly because of occasional irregularities in rhythm, I gained the impression that these loud calls were being uttered by two birds, probably a pair perching not far apart.

According to Anyasi, the best of my native informants, *Afropavo* feeds on the ground in pairs all day long. After sundown the pair flies up into the forest trees to roost. The calling is done from perches aloft. As proof of these observations I may add that Anyasi had killed one pair of the birds, after listening to them call in the evening, by locating them very early the next morning before they descended from their roost. We tried to find the birds I had heard calling, for it seemed that they must be within four or five hundred yards. But all our efforts and those of the dogs were unavailing.

After a brief visit to Stanleyville I returned on July 26th to Angumu. With great pride Nkotiba showed me the skin of a male "peacock" he had prepared during my absence. But that was the last one brought in during my stay of two months in the Congo. During the next twelve days I gave more attention to the training of the two skinners who would remain at Angumu, and visited a few of the smaller mining camps in the vicinity. Though I heard a great deal about the "peacock," I found no more opportunity to hunt it, and on August 7th I left by motor-truck on my long trip to Uganda.

Often I have been asked how it happened that *Afropavo* escaped my attention and that of other ornithologists for so many years. The explanation is that its range seems restricted to a part of the Upper Congo forest where none of us ever did any systematic collecting of birds. Roughly speaking, this area extends from the southern edge of the equatorial forest in the Sankuru District northeastward to the country just south of Stanleyville, the vicinity of Bafwaboli, Batama, and Opienge. It may reach the base of the eastern mountains near Walikale. Because of its nocturnal calling, the natives must be acquainted with this bird wherever it occurs. While the real distribution may be somewhat more extensive than we yet realize, it certainly cannot reach the middle Congo near Lukolela, nor does it seem anywhere to touch the northern edge of the equatorial forest. I doubt very much if it now exists north of the Aruwimi or Ituri rivers, or in the Semliki Valley.

One possible explanation of this restricted range may be its extirpation from a large part of the forest by natives. Pygmies would find it relatively easy to shoot the birds with arrows from trees at daybreak, after locating them by their calls. Natives hunting with dogs during the day must often force them to take to the trees, where they are said to perch even more patiently than forest guinea-fowls.

If this be the case, there is all the more reason to hope that *Afropavo* will soon be given protection. Once the necessary specimens have been collected for the important museums of the world, I know that the Belgian Government will place it on the list of protected species. Whether this interesting pheasant can ever be completely protected from the forest-dwelling natives is a serious question, but we may be sure that it is still fairly numerous in the part of the country delimited above.

Although my original feather came from Avakubi, my belief that *Afropavo* does not now occur there was strengthened by conversations with natives along the Ituri Road from Bafwasende to Irumu. Likewise at the Epulu River my friend Pat Putnam has been unable to learn from natives of its existence. My specimens were shown to natives in the Semliki Valley and at Lutunguru in the mountains west of Lake Edward with no better results.

From Angumu I traveled by truck and motor coach to Irumu, and then by automobile to Lake Albert, the new Ruwenzori National Park, the highlands west of Lake Edward, and the Albert National Park in the Kivu District. Many old friends I met there, and many new ones I made, and I regretted having to make haste toward Uganda, where my place was reserved in an Empire flying boat leaving Port Bell on August 27th. Both Belgian and British air lines were marvels of efficiency. In four easy days from Lake Victoria one can now reach London. But I disembarked at Marseilles and continued to Tervueren by rail.

My welcome at the Congo Museum was of the warmest. Doctor Schouteden exhibited with joy the male *Afropavo* received during my absence from Mr. Wilson, and I got out the specimens brought with me by airplane. Doctor Dyleff had written me, too, from Angumu to say that shortly after my departure one more skin had been prepared for the Congo Museum by the men I had trained. So within a year we had increased the known specimens of Congo peacocks from two to fourteen. This success was due to nothing so much as the friendly cooperation and enthusiasm of everyone associated with the search.

RE-CREATING THE AMERICAN WILDERNESS

Continued from page 749

that covers them in their growth, and he was secured as our second specimen.

Our hope now grew for the early completion of our collecting, for we felt the others would now be easy. More days passed, and a second snow came to carpet our forests for good tracking. Then, one late afternoon we went back on a ridge, where elk signs were always most plentiful. Before we began our hunting, we heard a bugle across the valley, and looking into a patch of dead timber, saw a magnificent big bull. He was headed up the valley in our direction, and we anticipated there was a good chance of seeing him later.

As we climbed the open ridge, sprinkled with burnt timber, we heard another bull bugle, and then another, both up the ridge ahead of us. As one seemed to be working our way, I reclined by an old stump and searched the timber to locate him. Shortly, I saw patches of brown, and waited. As he slowly worked his way in my direction, feeding and bugling as he came, he had no suspicion of my presence and approached to within twenty yards before he saw me. During this time I had opportunity to study his horns, which, although very good, were too small for our group. So I let him come on, to see how really close he would approach.

He was little concerned, and bugled several times between pauses to look me over, and not until I stood up did he go away. All this while the other bull above had been bugling, and as I made my way toward him, I bumped into still another, but let him go his way also. They were all about the same size, not quite good enough for our group.

My thoughts turned to the big fellow we had first seen, believing he might be making his way toward these three in answer to their challenges. While heading for him, I passed a cow, but left her undisturbed in favor of the bull. Darkness closed in on us, and I never again saw the big bull, but did have a thrilling two hours.

Days passed, with golden sunshine and blue skies. And then I got the calf, and a beautiful specimen it was, picked from a small herd so far from camp that it took us all the next day to go to it, skin it out and return.

We now turned our attention to the big bull and the cows, which we expected would not be difficult to secure, and then we would all be heading homeward.

One evening, as the sunset and the twilight were turning to darkness, we were riding back to camp, picking our way through down timber, figuring the day was done. From the depths of the timber there suddenly came a deep bellow. I jumped from my horse and grabbed my gun and advanced cautiously on foot, suspecting I might see a good bull. He was standing watching me approach, but I did not locate him in the dim light until he moved. Hearing our horses approaching, he had, as they often do when rutting, suspected it to be another bull, and he stood ready to challenge. As I came closer, I saw he had good horns, and brought him down. He was a fine old male, and as it was then too dark to do the skinning, we left him, to return in the morning with the horses.

Four elk were now in the bag, and again the two "easiest" ones to get were still out. We had all looked lightly on the thought of securing the cows, but now we began to take it more seriously, for we realized that in all our two weeks or more of hunting we could not have got one if we wanted to. The very few we had seen offered no real opportunity, except those McConnell had happened on the first day, when he was concentrating only on securing a bull and had passed them up.

Then we tried some new country to the west at the head of the valley, where just under the Great Divide the snow still carpeted the deep forest. Tracks were plentiful, but we could not find an elk. Cautiously following one track, which we were sure was that of a single cow, we finally came to where she had not long before lain down in a characteristic position from which she could watch her back trail. She had seen us coming long before we could see her, and the deep prints in the snow and under-soil told where she had bounded off.

In this thick and broken timber, to see a still object of similar color is like "looking for a toothpick in jackstraws." It was so utterly impossible that we never attempted it until the very last, when anything had to be tried.

Another fresh cow trail took us up hill and down dale. Seemingly knowing she was being followed, she played on us all those little tricks of crossing streams and circling to look behind, until, nigh exhausted and far from camp, we had to give her up.

Then came the next to last day, when I just had to pull out and head back to the Museum. Long since Mr. Puthuff and Mr. Petersen had finished their work in Jackson's Hole, had returned to Cody, packed up and returned home. I had remained only for the elk. Doubtful as to our success on these two last days, I had made plans to leave camp on the following Sunday morning and go in light with the horse-wrangler some twenty miles to the Ranger's station, where a car was to meet me and take me the rest of the way. If I was not successful, I had arranged for the guides to stay in another four or five days and try for the two cows.

Friday morning broke clear and fine and found us again hunting our most likely country on foot, as the most precautious method of stalking, although our cruising radius was thereby limited. While we knew cows were plentiful elsewhere, in our particular valley they seemed for some unknown reason to be very scarce. Before noon luck most fortunately broke in our favor, for we encountered our first real bunch of cows. Fearing to attempt a closer approach, some long shots across the valley brought down one, and then another. Elated, we hurried to the closest one, which had been the second to fall, and prepared this for skinning.

Going over to the other, which had fallen out of sight, we were much surprised to find she had gotten up and made off. Fortunately, by a good piece of trailing by the guide we were able to follow, but it was not until we had gone another mile and a half in a right-angled direction that we caught up to her again and brought her down at the bottom of a steep rocky draw.

By the time we had her dressed out for cooling, it was getting on in the afternoon and, being far from camp, we decided to leave them both and come for them the next morning with horses and the boys to skin them and bring them in. Although we had left other specimens out over night, as nothing will touch a fresh kill, not even a coyote, we tied a red handkerchief as a precaution on one ear of this last cow, especially as she would be the last to be skinned.

It was a buoyant and joyous camp that evening, when at the eleventh hour we had finally secured our last two specimens and had successfully completed our group and expedition. All were anxious to head homeward with me. Now we could all move out Sunday morning in triumph, for we still had Saturday to prepare the skins and do some necessary packing.

Saturday morning found us all up early. Horses were saddled and packhorses made ready to bring in the skins, skeletons and meat. All guns, and even glasses, were left in camp, for fear we might see something we would be tempted to shoot and that might delay us another day.

As we approached our first kill, two golden eagles, flying overhead, told us the position, yet we little suspected why they were there. As we rounded the hill, our hearts sank, for there was a grizzly and two cubs. Up she got and ran off, with her babies following like balls of fur. It was a bad omen, but we could hardly believe she had disturbed our kill.

Yes! She had done the most remote thing conceivable. Where we had left our fresh kill there was a great mound of earth. We suspected that our elk lay buried beneath it, but we soon found it was only the entrails she had buried. Below lay our cow, with great patches of hair pulled off the back—the result of her being dragged downhill. The grizzly was just beginning to bury this, when we came along.

As badly damaged as the skin was, I took it with the hopes that somehow I could arrange it in the group so the damage would not show. We were encouraged somewhat by the thought that the other cow must be safe, since she was so well hidden in the deep ravine.

With horses loaded with skin, meat and bones, we despatched the horse-wrangler straight for camp, while my two guides and I headed for the second elk. All was well until we neared our kill. There in the snow we saw a bear track, and later some of cubs.

Could it be possible? We did not think these tracks could possibly belong to the same bears. Even if they did, we felt confident they had not found our elk. It was just a coincidence, we believed, that they had passed that way. Having given so much attention to the one, she surely must have missed the other, and on we went, but alas, only to find our elk completely ruined. Nothing remained but a frayed mass of skin, flesh and bones. The handkerchief was still there, tied to the one ear; it had held no fear for her. What we said about grizzly bears with cubs is not fit to print.

Again the all but impossible had happened. It was just something that is beyond belief. But it happened, and I just had to leave, hoping that the boys, who had promised to stay behind and try for another, might be successful.

THE SNYDER MOUNTAINS

Continued from page 759

the base of Cathedral Mountain, which led them into a vast high-walled amphitheatre. They saw signs of bear and two goats high up on the peaks to the north of the canyon. However, a blinding snow storm swept down from the ice-fields and drove the hunters to shelter.

The next side trip included Sandy, Jim and me. We scaled the ridge back of camp and over the saddle into what was apparently a good game valley. We made camp at the border of timber and pushed on the next day with a view to collecting about six miles farther up, at the base of an iron mountain. As we approached we discovered four goats, two directly ahead on the iron mountain and two on the slopes at the right-hand side. Jim went for the two on the mountain and Sandy started his stalk for those on the slope. Sandy made a good stalk and got both goats, bringing them down with two excellent shots. Jim's goats, however, watched the whole procedure and as he made his stalk they worked higher on the mountain, passed over the other side and disappeared out of sight.

At the foot of the mountain there was a small lake, the outlet carrying a fair head of water which disappeared down a sink hole. Deep down in the crystal clear water I could see the skeletons of two bull moose with locked antlers. "The end of every wild animal is a tragedy," says Ernest Thompson Seton. How true it proved here! These animals had fought a mortal battle on the frozen lake. Both had either died in combat or eventually succumbed to starvation. We got a fair collection of small mammals here. Sandy got another big goat and a cow and bull caribou.

We all returned to base camp on Glacier Lake and found that Ted, the cook, had had some more trouble with bears. Two of the animals had been in the meat cache and got a little too bold. Ted took a shot at one of them and according to his story he knocked the biggest bear down; but on approaching, the apparently dead animal got up and plodded into the timber. Later, I saw a grizzly bear swimming across the lake directly into camp, but by the time I had my camera ready he had already landed and Jim brought him down. This proved to be the same animal that Ted had shot, as shown by a bullet hole through the fleshy parts of his hind limbs. Just then we saw a tiny speck over the mountain ridges, which proved to be the plane coming to take us out.

We still had a group of mountain sheep with black tails, a caribou and a moose to collect for the Canadian National Museum. Fred Lambart, Jim Ross, Karl Stein and Joe flew down to Mary River on the Nahanni to collect these specimens and bring out the boats. The plane returned to Glacier Lake, and Sandy and I prepared to fly out. There was an unfavorable breeze blowing down the lake which made it necessary to take off in the wrong direction. Stan nosed into the wind and we were soon off the water but headed for a wall of jagged mountain ridges in a relatively narrow canyon, which was constantly growing narrower. Stan, by gaining as much altitude as possible and judging his time to what seemed a split second, banked sharply to the left and swooped downward in what was almost a power dive, and got the plane around. Then all of us, including Stan, heaved a sigh of relief.

We spent two days at Fort Simpson waiting for fair weather, and Bob Randall, who had been searching for the lost Russian fliers, flew us to Fort Smith. I stopped here over night at the Hay Camp for Mrs. Goodwin, and Harry Hater flew us the next day to Cooking Lake. Here our three-months' expedition ended. We had mapped uncharted regions and accumulated a wealth of scientific material that will add to our knowledge of the wild life in Northwestern Canada.

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LETTERS

Sirs:

My question is suggested by Dr. Andrews' interesting article, "Wings Win," published in the October issue of Natural History. Would it be possible to give me the speed of bees and wasps, especially that of our common honey bee?

. . . And now to comment on your magazine, Natural History. We have held a subscription for several years, and have always enjoyed the articles it contained as well as the fine illustrations. When the change was made from the original size to the present larger size and shape, I was a little skeptical about any improvement; but now, after more careful thought, and comparison, I have concluded that there is a decided improvement. I like the new size much better, for with larger pages and more space, I find the arrangement of the single pages, and the effect of the entire magazine, much more attractive.

The other members of my family and I look forward to the arrival of each copy, and enjoy the interesting and informative articles contained in Natural History. May we all congratulate you on the high standard you have set for your staff, and the excellence you have attained in your magazine, Natural History?

Bruce D. Miller.

Schenectady, N. Y.

* * *

Sirs:

When I opened my Natural History I was at once attracted by Dr. Roy Chapman Andrews' article "Wings Win." . . . I was glad to get some direct light on the work of the man who made the original estimate of the speed of the deer bot fly and should like some more light on just how he deduced his results.

I have been studying the honey bee for 53 years. I have tried in different ways to get the flight of this insect. It has often been said that the honey bee could fly 60 miles an hour. I have noticed that when the wind gets to 30 miles an hour the bee either stays in the hive or else flies in the shelter of trees, buildings, etc. It finds it very difficult to make headway against a 30-mile wind. Its speed is greatly influenced, however, by temperature, its muscles being rendered sluggish by cold. The bee is very sensitive to temperature changes and is able to keep the temperature of the brood nest at about 95° even though the outside temperature be over 100° or below 32°. One winter day when the outside air was close to zero I thrust the thermometer down into a clustered colony of bees. The temperature of the inside of the cluster was 65°. A few minutes later it was over 80°, due to the disturbance of the bees. A bee cannot fly much below 40°. At 50° it will not continue work. It will work at 60° but will not remain away from the hive long. But at 70° and over it is very active. I think that it is possible that at 90° a bee might sustain flight against a breeze of 50 or possibly 60 miles an hour if it was carrying no load. But it tires very quickly and would surely fly only a short distance against a gale.

I once hived a swarm of bees in the northwest corner of my seashore cottage. All the next day there was a westerly wind with a temperature of about 60°. Those bees were literally blown away. There were about 30,000 in the swarm, but in two days there were only a few hundred.

I was glad to note that you would like to see the fly tried out in a wind-tunnel. The only possible way that I know that the deer bot fly could be timed with any accuracy would be to set up photo-electric cells with a timing device, after the manner of measuring the speed of a bullet, and then wait patiently until an accommodating fly took the desired course. Even Professor Townsend acknowledges that he *estimated* the speed. He does not say that he measured it. Honestly, I think that the estimate of 400 yards a second is beyond all reason. I would be glad to lay a wager that the deer bot fly could not fly through a tunnel where the wind was 200 miles per hour unless said tunnel was extremely short and the fly got up speed with a helping wind.

Have you stopped to think that we have had no instance cited of eyes being put out by bot flies? I think that if I went to the heights where these flies were sporting I would wear heavy goggles. If a fly going 800 miles an hour struck the open eye it would absolutely destroy the sight. Why have we not found bot flies imbedded in such materials as would yield, or smashed flat against stationary objects? Is this insect also blessed with wonderful braking power? Can it turn at a sharp right angle when going 800 miles per?

Allen Latham.

Norwichtown, Conn.

* * *

Sirs:

. . . Though it would be difficult to estimate either the propulsive force of the deer bot fly or the air resistance, it will be very hard for aerodynamicists to reconcile a speed of 400 yards per second with accepted principles. When speeds approaching those of sound are reached, the most beautifully streamlined bodies develop what is known as a compressibility burble with shock waves, and their resistance goes up tremendously. It would seem as if the present forms of streamlined aircraft would have to be radically modified for speeds at or near the speed of sound. Instead of a rounded bow, sharp entering edges have to be provided on wings and body. With the best modifications for compressible speed flight in sight today, that is with thin bodies instead of thick bodies with rounded bow, many fine authorities estimate that the maximum possible speed of the airplane, with all obstructions removed and with this modification of fundamental shape, would not possibly exceed 600 miles an hour. The shape of the bot fly, as it appears in your magazine, would not appear to be of the form suitable for compressible flight. No matter how cleverly its propulsive mechanism is designed, this could not, of course, exceed 100% in efficiency. . . . The question would arise, has the body of the bot fly found a way of avoiding the compressibility burble and has it found a way of producing the equivalent of a motor which would be almost supernatural in its characteristics?

Alexander Klemin.

Daniel Guggenheim School of Aeronautics, College of Engineering, New York University.

* * *

Sirs:

I read with a great deal of interest this morning Roy Chapman Andrews' article "Wings Win." As a breeder of swans for several years, I was particularly interested to see that the chart you published showed that the whistling swan's top speed, as recorded by aeroplane observers, was 55 miles per hour. In going through my notes I find that Sharpless claims that they fly 100 miles per hour, while Daglish claims that they attain a speed of at least 80 miles per hour.

E. E. Poor, Jr.

Carlton Hill, New Jersey.

* * *

Sirs:

I have read with much interest your article in Natural History in regard to the relative speed of different birds and animals. I find on your table one statement which is so surprising to me that I take the liberty of writing to ask whether it is a mistake or whether my ignorance is more abysmal than I thought. It is stated that the Black Duck travels at 26 miles per hour. Now, of course, the Mallard and the Black are very nearly identical birds. I have shot a great many of both and I never noticed any material difference in the speed of flight; for which reason it is quite incomprehensive to me that the speed of a Black Duck should be only approximately that of a Partridge, of a Rail, or of a Beetlehead Plover. There is no question in my mind but that the reason why I have missed the many, many Black Ducks I have is that I underrated their speed and shot behind them. Is it perhaps possible that the figures became reversed and that the speed of the Black Duck is about 62 miles instead of 26, which would bring it in line with your Mallard?

John Heard.

Boston, Mass.

The speed of 26 miles an hour for the Black Duck is correctly quoted from the paper "The Flight Speed of Birds," by May Thatcher Cooke, published by the U. S. Department of Agriculture. But its author acknowledged, as did NATURAL HISTORY Magazine in publishing the chart, that the speeds recorded are not necessarily the highest attainable but only the highest that conscientious search can reveal. NATURAL HISTORY gratefully welcomes the above letters and any others which may add to the existing information on the subject of speed.—THE EDITOR.

Sirs:

Permit me to congratulate you personally on the wonderful monthly issues of our NATURAL HISTORY magazine of the American Museum of Natural History.

I must confess it was a new venture getting used to the larger size issues since last January. However, I am well aware of the advantage of larger size pages which set off so well the many *illustrations which are in themselves a work of art*. . . .

I am an anthropologist and follow with especial interest the many activities in Dr. Clark Wissler's department.

In closing, I wish you and the American Museum staff great success in yours and their ventures, and please always believe me a loyal member of the American Museum.

E. B. POWERS.

San Diego, Calif.

* * *

Recent Museum Publications

NOVITATES

No. 954. Notes on the Clark Fork, Upper Paleocene, Fauna. By George Gaylord Simpson.

955. The Skeleton of Styracosaurus with the Description of a New Species. By Barnum Brown and Erich M. Schlaikjer.

956. A Gatun Ostracode Fauna from Cativa, Panama. By H. N. Coryell and Suzanne Fields.

957. Results of the Archbold Expeditions. No. 17. Some Original Observations on the Habits of *Dactylopsila trivirgata* Gray. By A. L. Rand.

958. New Anthophorid Bees from California (Hymenoptera). By P. H. Timberlake.

959. A Pug-Headed Two-Lined Dab, *Lepidopsetta bilineata*, The Only Known Pug-Headed Flatfish. By E. W. Gudger.

960. Bees from Morocco. By T. D. A. Cockerell.

961. Report on a Collection of Spiders from Mexico. I. By W. J. Gertsch and L. Irby Davis.

962. Studies of Peruvian Birds. No. XXVII. Notes on the Genera *Muscivora*, *Tyrannus*, *Empidonomus*, and *Sirystes*, with Further Notes on *Knipolegus*. By John T. Zimmer.

963. Studies of Peruvian Birds. No. XXVIII. Notes on the Genera *Myiodynastes*, *Conopias*, *Myiozetetes* and *Pitangus*. By John T. Zimmer.

UP-STREAM FOR MOUNTAIN GOATS

Continued from page 738

shooting two of the four specimens taken, on her very first hunt. John Lyman shot another and Christensen a magnificent one, but I missed my only chance.

But the exploit which will be the hardest to forget in the years to come was the time early in the expedition when Abbey, at the height of her terribly effective innocence, fished for salmon with a trout fly. Now so far as I know, no humpy salmon had ever struck at a trout fly until Abbey came along. But one of them struck at hers and—you can take this or leave it—she landed it with a 3¼-ounce trout rod.

During all our hunting days Joseph Guerry busied himself painting the mountains, rocks and glaciers for a background of the Goat Group. He also gathered the heather, grass and flowers which grow on the heights where the goats feed so the actual plants preserved in barrels will be available to use in the exhibit. Christensen in addition to being a hunter was chief trapper, with Abbey Kissel and Mrs. Clark as his assistants. Each night he laboriously set out thirty or forty traps for small mammals and gathered them at daybreak. His bag was small, a few mice and two shrews over many days. But he did get a bushy-tailed rat.

I have not tried to describe Alaska's superb forest or to picture the shivers the great smooth rocky peaks gave us when we saw and knew we had to climb them, nor the way the hair bristled on our necks when we walked the bear paths in the dark along the banks of the salmon creeks, but these are things we shall not any of us soon forget.

As we sat on the *Westward's* deck sailing back for Ketchikan, we all wished there were some way to adequately thank those who made our trip for us—the staff of the American Museum, the officials of the Alaska Game Commission, Mr. Campbell Church, Jr., of Seattle* and the men and women of Alaska with whom we came in contact and for whom we conceived the greatest admiration; to these, we six shall ever be grateful.

---

*Owner of the *Westward*.

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RECENTLY ELECTED MEMBERS

In addition to the names omitted from last month's Natural History owing to lack of space, 835 persons have been elected members of the American Museum.

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